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Truck Driving Pattern and Use Survey Phase II Final Report, Part I

Wilbur Smith and Associates, Columbia, S.C.

Prepared for

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TRUCK DRIVING PATTERN AND USE SURVEY
PHASE II -
FINAL REPORT, PART I

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Mobile Source Air Pollution Control
Emission Control Technology Division
Ann Arbor, Michigan 48105

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16. ABSTRACT

The report covers activities in Part I of Phase II of the title study, which developed sampling plans and instrumental 50 heavy duty trucks in normal operation in New York City for 172 days, and, similarly, 5 transit buses for 15 days. Operational profile data included: engine speed, engine load factors, vehicle speed, engine temperature, and throttle valve closure. These data, obtained from sensors installed and calibrated with vehicle operating on a chassis dynometer, were recorded in digital form at 0.863 second intervals on magnetic tape cassettes. Recorded data was edited and certain values translated to engineering terms using calibration data obtained at time of instrumentation installation. The report describes the sampling plan, instrumentation equipment, calibration methods, edit procedures, survey vehicle types, and technical problems encountered and their solutions. A set of 14 raw data and 14 calibrated, machine-compatible tapes were generated which are available separately from sponsor. Operational use profile data thus generated was basic input to generation of driving cycles for emission testing programs in subsequent program phases by EPA.

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PHASE II -

FINAL REPORT, PART I

by

Wilbur Smith and Associates
Bankers Trust Tower
Columbia, S.C. 29202

Contract No. 68-01-0478

EPA Project Officer: Leroy Higdon

Prepared for

ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Mobile Source Air Pollution Control
Emission Control Technology Division
Ann Arbor, Michigan 48105

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Chapter 1

INTRODUCTION

This report covers Part I of the study entitled "Truck Driving Pattern and Use Survey - Phase II," performed for the U. S. Environmental Protection Agency under contract number 68-01-0478 and for the Coordinating Research Council, Incorporated, under separate contract. This jointly sponsored project was under the technical guidance of the APRAC CAPE-21-71 Project Group.

The Phase II study comprised the following major tasks: the Analysis of Phase I data* to develop appropriate stratifications by approved sample plans of the truck population over 10,000 pounds gross vehicle weight (GVW) in both New York City and Los Angeles County; instrument 50 trucks engaged in their normal functions and obtain 172 truck-days of data in each of the two areas in accordance with the sample plans; process the collected data to a meaningful form and determine vehicle modes of truck use, both individually and statistically summarized. The survey also required the instrumentation of 5 buses and the acquisition of 15 days of operational data in each city.

Several sample plans were developed during this survey period. The final plan employed stratified trucks by borough where truck operations began, by truck type (wheel configuration) and by fuel type.

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* Wilbur Smith and Associates, "Heavy Duty Vehicle Driving Pattern and Use Survey, Final Report, Part I - New York City" for EPA and CRC, APDT-1523; also, "Heavy Duty Vehicle Driving Pattern and Use Survey-Draft Final Report, Part II - Los Angeles Basin" for EPA and CRC, February, 1974.

Trucks were then obtained through owner agreement to fit the stratified sample, were instrumented and calibrated, and returned to owners for normal operation over a number of days, also defined in the sample plan. The instrumentation of 52 trucks and the accumulation of 185 days of truck use data were accomplished during this study. Also, use data for 4 buses operating on both local and express routes for 14 days were collected.

The instrumentation included the installation of a data acquisition system comprised of a Government furnished Metrodata DL 620B Data Logger, a Wyle Laboratories designed and built Signal Conditioner module, and appropriate sensors to monitor engine rpm, load factor, vehicle speed, engine temperature and throttle valve closures. Manual inputs, operated by an on-board observer, recorded road type and traffic condition in 3 variables. After the truck's instrumentation and prior to return to normal use, the sensors were calibrated against the parametric quantities being monitored to enable the generation of models for further data processing.

The operational data were scanned once each 0.863 seconds, converted to binary coded decimal (BCD) form and recorded on 1/4-inch tape cassettes by the data logger unit. These cassettes were examined by data validity checks and if acceptable were transcribed to 1/2-inch computer compatible 7-track tapes. These data were further edited to contain only actual survey data. Header identification data was added and transcribed to raw data tapes. A total of 14 tapes comprised the available survey data related to the New York City survey. These raw data were then converted to engineering units such as R.P.M., miles per hour, etc., by the application of calibration models developed for each truck to provide 14 calibrated tapes of data for the surveyed trucks. In the latter data, the load factor raw data was not converted to horsepower, but was retained in original sensor output form.

Although computer programs were developed to process these data into horsepower and then into vehicle modes and to statistically combine these data into summary statements defining vehicle pattern and use, these were not applied to data collected due to technical problems and limitation of funds. Programs for this process are discussed in the appendices of this report.

This report covers only the New York City survey. The Los Angeles survey was conducted by EPA with support from Olson Laboratories.

Survey Data Availability

Survey data is available from either the Office of Air and Water Programs, Mobile Source Air Pollution Control, Emission Control Technology Division, Ann Arbor, Michigan, 48105, or the Coordinating Research Council, 30 Rockefeller Plaza, New York, New York, 10020. These data, applicable to New York City only, consist of 14 raw data tapes and 14 calibrated tapes.

SUMMARY

The program began in the Spring of 1973. The instrumentation was developed, and demonstrated in formal qualification tests. Sample plans based on Phase I study data were developed. During this period a number of technical problems arose which resulted in a cessation of field survey operations in November 1973 after data had been taken on 17 trucks for 60 truck days and 4 buses for 18 days. Reliability of recording and reading field data was extremely low due to a combination of technical difficulties, mostly centering around the instrumentation.

An evaluation and improvement program was undertaken by the contractor to locate and correct deficiencies in instrumentation, analyze and establish accept/reject criteria for field data collected and to be applied in future field collection procedures, and to continue computer program development in preparation for data processing. The results of this program are summarized in Appendices B and C.

These difficulties were identified and resolved through equipment modification and data validity check development. Analysis of data collected indicated that 49 days of data involving 15 trucks and 14 days of data on 4 buses were acceptable under these new criteria. Field survey operations were restored in May 1974 and concluded in October 1974.

A summary of the survey operations follows.

Representative Sample

The number of trucks in each city as well as the two areas included in the survey were originally dictated by funding available. The sample size selected, 50 trucks in each area, is an extremely small sample of truck population. New York City and Los Angeles County were selected as representative of the extremes in urban traffic conditions. New York is characterized by an older city with high congestion and intensive land use. Los Angeles county is characterized by lower congestion and less intense land use, with a well developed network of urban freeways. Within Los Angeles County are many areas representative of smaller communities in both traffic demand and facilities to meet these demands.

Basically, three sample plans were employed during various stages of the survey. These will be discussed in more detail in the body and appendices of the report. The sample plan finally applied in New York City consisted of 30 categories or cells. Trucks were stratified by the 5 boroughs of the city, 3 vehicle types, and 2 fuel types. The numbers of trucks and the number of sample days were assigned to each category according to an EPA-generated plan, which was a modification of the statistically design plan generated by the contractor.

In addition to 50 trucks to be surveyed in each city, 5 buses were to be sampled for at least 15 days to determine vehicle pattern and use data.

Truck Acquisition

New York State Department of Motor Vehicles was the initial data input to the truck acquisition according to the sample plan. These data did not contain some of the required information to fit trucks into the 30 categories. Vehicle owners had to be contacted to obtain these missing data before the registration listings could be matched to the sample plan.

Owners were then approached concerning their voluntary participation in the survey. Less than 10% of those contacted actually participated. As an incentive and to defray costs to owner for truck delivery to the installation site and return, a payment was negotiated with him, ranging from $75 to $150.

Trucks were scheduled for installation at the New York City Air Resources Board laboratory facilities in Brooklyn.

Truck Instrumentation

The instrumentation installed in each of the survey trucks consisted of a Metrodata DL620B digital Data Logger, a Signal Conditioner Module to interface the digital equipment with the sensors monitoring the various truck parameters. The Data Logger provided the facility to record, on 1/4-inch cassettes, the data being sensed. The format of these data was 4-track parallel BCD information recorded sequentially in 10-channels with scans at 0.83 second intervals and a parity check at the end of each scan.

Parameters Measured - The data on the cassette consisted of the following: assigned truck number, time in hours and minutes, engine rpm, engine load factor, vehicle speed, road type in 3 levels as determined and entered into the system by the on-board observer, traffic conditions also in 3 levels obtained in a similar manner, throttle valve position - open/closed and engine temperature sensor output. The 10th channel, a spare, was employed to record various data as annotated on the cassette for other analytical purpose.

The sensor selection and installation was governed by the nature of field survey type operations. A nominal 4-hour period was allowed for installation and calibration. This produced some compromise in the techniques of measurement and sensor location. Of all the parameters that were measured, load factor was the most difficult to obtain and is described in detail in Chapter 4.

Instrumentation Calibration - Each sensor was calibrated prior to or during installation. Load factor sensors were calibrated against wheel horsepower on a Clayton water-brake dynomometer. Engine RPM and vehicle speed sensors were also calibrated during this period. Engine temperature sensors were calibrated against ambient temperature and boiling water. These data were recorded for each truck installation for subsequent generation of calibration equations to be employed during data reduction processes.

Attempts were made during the field calibration period to obtain maximum horsepower output by obtaining calibration points in the "backside" of the horsepower curve. Due to various physical limitations of chassis dynamometer and truck conditions, these data were not obtained for all trucks.

Instrumentation Validity Checks - Operational checks were performed approximately each 30 minutes by the on-board observer to check general operational integrity of the installation during survey operations. Post-calibration validity checks were performed by technicians at the end of each survey day. These checks included test for "engine off" and "idle" engine RPM and load factor indications. A 60-Hz signal verified sensitivity of instrumentation had not changed on channels for both engine and vehicle speed. The temperature sensor was checked for normal readings. Malfunctions in either test were corrected and recorded data were examined against accept/reject criteria to determine validity and usefulness of data obtained. Extension of test was made in most cases if data for that day were rejected.

Data Processing

Data processing consisted of the following steps:

- Validity check of Metrodata cassette data
- Translation of 1/4-inch cassette tape data to 1/2-inch computer-compatible tape.
- Edit of translated data tape
- Final validity test of translated tape
- Creation of raw data tape
- Creation of calibrated model for engine rpm, vehicle speed and engine temperature.
- Processing of raw data tape to convert selected outputs to engineering terms (viz. engine rpm sensor output to rpm, etc.)
- Creation of calibrated tapes.

Raw Data Tapes - The raw data tapes contain individual scan data indicating, for each truck day, the scan number, time in hours and minutes followed by sensor values for the vehicle parameters. Each data set corresponding to a specific truck and truck day has header information defining truck identification, engine rpm model coefficients and constant engine temperature coefficient, and constant vehicle speed coefficient, and load factor calibration data. Editing of translated tapes was accomplished. In addition, the wheel horsepower-model developed from the Clayton dynamometer calibration run and validity check data is given. The raw data tape is written in 9-track BCD, 800 bytes per inch Extended Binary Coded Decimal Interchange Code (EBCDIC) format which is compatible with IBM 360 series equipment. Data for each truck day contains approximately 8,000 to 67,000 data scans. Data for 52 trucks with a total of 185 truck days are given on these tapes plus data on 4 buses for a total of 14 bus days of operation.

Calibrated Data Tapes - The calibrated tapes consist of raw data translated to engineering terms by the application of models developed from calibration data, with the exception of channel 4 (horsepower) which has been left in load factor sensor output. The format is a 9-track format similar to raw data tapes except that it is in floating point.

Survey Funding Limitations

Due to a combination of factors, the survey activities were not funded beyond the end of the New York City survey. These factors included extreme technical difficulties in instrumentation and lack of sufficient response and participation by truck owners. Cost overruns from these problems resulted in no further funding by the sponsors beyond the data processing described above as applicable to New York City.

CONCLUSIONS

The survey produced data on 52 trucks operating for a total of 184 days in New York City. These data are in general agreement to the final sample plan for the survey. These data are available in both raw data and calibrated data form in 28 total data tapes. Within the constraints of sample size, these data can be considered representative of truck use in New York City.

The survey employed wheel horsepower measurement correlated with appropriate engine load factor and rpm measurements. Wheel horsepower measurements were obtained, since drive train losses were not subject to measurement under field operation constraints.

Models created from Clayton dynamometer calibrations under driving conditions proved to be inaccurate when the engine was in the motoring or dynamic braking mode. Without calibration data obtained on a dynamometer capable of motoring the engine, no suitable model was generated for this mode condition. Such a dynamometer was not available in the field. Further, there was no constraint imposed on the model that at idle condition, the horsepower be at or near zero. While in most cases, zero horsepower values were included in the calibration data, the model development procedure, that of multi-regression analysis, did not necessarily produce such a result. Had the data been processed by the mode determination program, these zero horsepower decisions would have been made by provisions therein. For these reasons, the horsepower models developed for each truck may not prove to be acceptable for all potential users.

The problem of correlating wheel horsepower to engine horsepower and the resolution of the dynamic braking mode problem was also conceded to be not a part of this project.

Under a Phase III contract, the raw data will be correlated with engine manufacturer's data to create a suitable horsepower model enabling the conversion of wheel horsepower and load factor data taken in this survey to engine net horsepower and a rationalized percent of rated horsepower.

The maintenance and general physical condition of trucks in the survey was generally poor. Many trucks did not have serial number or engine number identification data which could be located. These data were not reliably available from registration data. Based on owner identification, license plate, and truck manufacturer data supplied by the contractor, EPA has obtained these data from various sources related to the survey trucks.

The data in the survey data file includes a small number of zeroed scans. In addition, some editing of data has been accomplished to zero some data on the basis of rationales given in this report. Tests performed by the contractor indicate that these zeroed data to a level of 10% of total scans did not influence the mode determination potential of the data to a significant degree, provided the data processing program was carefully written to anticipate and account for these zeroed data. After the instrumenting difficulties were corrected, this error rate seldom exceeded 2 percent. Programs prepared but not applied by the contractor do adequately process these data with satisfactory results in the presence of these zero scans. These or other suitable techniques are recommended in future data processing activities.

The scan data is sampled data at intervals of 0.863 scans per second. Combinations of only two subsequential scans can produce conclusions which may be misleading. It is recommended that more than 2 consecutive scans be included in the logic of analysis to smooth this sampled data. Programs were written by the contractor to include "N" scans of data when attempting to locate transitions in conditions, such as mode changes. Preliminary tests indicate that the number of scans included should be about 5 in a running average type or other process to produce stabile transitions logic. By this means, single zeroed scans can be accommodated by considering the time interval between the adjacent good scans as 1.726 seconds rather than 0.863 seconds or averaging the two good scans to estimate the values of the missing data.

RECOMMENDATIONS

A valuable insight into the operationl pattern and use of trucks in New York City could be gained through the further processing of the survey data. Mode determination and statistical analysis programs have been prepared and are described in the Appendices to this report which could be utilized for this recommended data reduction. Other forms of data analyses other than those related to truck engine cycle generation can result from analyses of survey data.

One area of further research appears urgently required if further surveys of this type are contemplated. This is in the field instrumentation of trucks to measure, with confidence, the horsepower or torque output of an engine in suitable field environments. This should not require the disassembly or modification of engine, transmission, torque tube, differential or drive wheels. If a suitable means were developed of measuring torque by a device which can be independently calibrated and then installed on the vehicle, the necessity to calibrate individual installations in a laboratory equipped with a chassis dynamometer would be eliminated. The truck could be instrumented at its base location. Not only would this have saved both time and money in this survey, it might have relieved the possible hesitancy of truck owners in releasing their trucks to an installation facility not under their control and supervision. The other sensors could be suitably calibrated without the chassis dynamometer.

It is further recommended that data recording in future field surveys of this nature be accomplished by a device producing tapes readily compatible with normal computer tape transports. Equipment available at the time of the survey to meet this requirement was relatively large. There was not sufficient room for both the instrumentation and an observer in most truck cabs. Problems associated with attaching an instrumentation package which would be weather-proof and environmentally controlled was discussed. In view of the fact that instrumentation had to be installed and calibrated in a few hours of truck availability the contractor and the advisory group decided not to use this approach, but to rely on the Metrodata unit which could be more readily installed.

Had a machine-compatible unit been available of comparable size, both program cost and time could have been saved. The data validation test could have been more readily accomplished using a computer directly to read and verify data tapes. The data processing procedures of translation and verification of the ¼-inch tape cassette to the ½-inch tape format would have been eliminated. The savings would have more than off-set the increased skill level requirements of more frequent tape loads and other operational problems.

Chapter 2

SAMPLE PLAN

Part I of the survey called for the instrumentation of 50 operating trucks in New York City to an approved sample plan and the collection of 172 truck-days of data defining the truck operations. At various times during the field operation, a total of three sample plans were employed. The derivation and composition of these plans is given in Appendix A. The final sample plan stratified the truck population by geographical area, truck type and fuel type.

The geographical areas were the 5 boroughs (counties) of New York City. A truck was defined as based in that borough in which its first daily trip originated, usually the destination of its last daily trip, even though operations might require travel in other geographical areas.

In truck type, 3 categories were chosen - two axle, dual rear tire, single unit trucks (2D), three axle, drive tandem axle consisting of 8 tires, single unit trucks (3A), and tractors of both 2- and 3-axle configurations (TT).

Fuel type was divided into gasoline and diesel engine categories.

The final sample plan is shown in Table 1, in which truck type and fuel type is indicated in vertical columns while the boroughs are indicated in horizontal lines. This matrix representation contains 30 district categories or "cells" into which 50 trucks were assigned. The number of trucks assigned to each

TABLE 1

SAMPLE PLAN DISTRIBUTION

NEW YORK CITY

TRUCK TYPE	2D		3A		TT	
FUEL TYPE	G	D	G	D	G	D
BRONX	(3)/11	(1)/3				(2)/6
BROOKLYN	(8)/32	(1)/5	(1)/3	(2)/4	(2)/8	(2)/6
MANHATTAN	(10)/38	(2)/6		(1)/4	(1)/2	(2)/6
QUEENS	(5)/17		(1)/3	(1)/2	(1)/2	(2)/6
RICHMOND	----	-----	------	-----	------	-----
TOTAL	(26)/98	(4)/14	(2)/6	(4)/10	(4)/14	(10)/30

	No. Trucks	No. Days
LEGEND:	$\downarrow$ (x)	$\downarrow$ /xx

cell is shown in parentheses. The number of days to be accumulated by these trucks are indicated beneath the slash.

The sample plan required a total of 26 two axle, dual rear tire, single unit trucks with gasoline engines to be surveyed for a total of 98 days. These were distributed in the numbers shown among the 5 boroughs. The same truck type with diesel engines was assigned a total of 4 trucks for 14 days, with assignments to 3 of the 5 boroughs as shown.

In the three axle, single unit category, a total of 2 gasoline trucks accumulating a total of 6 days and 4 diesel trucks for 10 days was assigned.

The gasoline-powered tractors in the sample plan totalled 4 units for 14 days, while the diesel-powered units totalled 10 for 30 days.

The distribution of total vehicles by type (axle configuration and fuel) were in general agreement with the original sample plan approved. The original plan statistically based the truck numbers to relative percentages of vehicle miles of travel. The distribution of the total number of days in the original sample plan was based on variability estimates of nature of truck use as determined by industry type of user. These statistics were based on the data generated in Phase I of the study.(1) The final sample plan distributed these days in a slightly different manner.

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(1) "Heavy Duty Vehicle Driving Pattern and Use Survey - Final Report - Part I, New York City" by Wilbur Smith and Associates for CAPE-21-71, EPA, and CRC, May 1973 (APTD-1523).

The division of trucks by type among the 5 boroughs of the final sample plan was generally determined by distribution of truck registrations. Truck registrations are not a reliable indication of truck location as defined in the sample plan. However, these data were considered the best manner by which assignments might be made.

Buses

The survey also includes data on 4 transit buses for an accumulation of 15 days operation. These data were approximately equally distributed between "Express" and "Local" bus operations.

Chapter 3

TRUCK ACQUISITION PLAN

To acquire truck owner participation in the field survey, two randomly accessed tapes were obtained from New York State Department of Motor Vehicles. These tapes were restricted to those vehicles with registered gross vehicle weight in excess of 10,000 pounds with owner addresses in one of the 5 counties comprising New York City. A total of approximately 3000 listings were available from this source.

Truck Selection

These listings did not provide some of the data required to sort trucks completely into the cell matrices of the various sample plans employed during various stages of the survey. The listings included categories of trucks by year, manufacturer, body type, number of cylinders and fuel type. The location of vehicle operation, and axle configuration were missing from the data contained in the listings. It was therefore necessary to obtain this information by direct contact with the owners before the listing could be categorized as potential candidates for various sample plan matrix cells in effect at the particular field survey stage. It was also necessary to recategorize trucks on which data had previously been taken with new descriptors as the sample plan changed.

Owner Contacts

The initial contact with the owner on the listing was by telephone. This required the determination of telephone numbers from published directories and directory service. The volume of these contacts proved so great that it was soon recognized that the task required 3 full-time telephone personnel to provide the necessary information to complete the truck and owner descriptors, acquaint owners with the general objectives of the survey, and discuss their participation in the survey.

When there was reasonable interest in their participation, a letter and sample contract agreement was mailed to the owner and followed up by personal contact by survey personnel to obtain a signed agreement. The installation was then scheduled to match sample plan requirements and period of truck availability.

Owner Response

The response to the survey by the vehicle owners was not as good as anticipated. To allow for attrition in other phases of the program, a list of 100 candidate-owners of trucks was prepared through solicitation. While this number was twice that of the 50 trucks to be instrumented, nearly all were subsequently contacted for participation. To obtain these 100 potential participants, over 1,200 listings had to be processed, a yield of less than 10 percent. An analysis of these unsuccessful contacts, including the various owner responses, is summarized in Table 2. Some negative responses were received from owners who felt antagonized or threatened by proposed regulations regarding truck emission and noise controls contemplated by the administration. While this directness was experienced in only a few declines, it could have partially explained additional refusals.

Table 2

TRUCK ACQUISITION RESPONSE

SUMMARY

Unsuccessful contacts

No longer own or not in service	49
Lease truck-owner not willing	6
Based/operated outside area	32
No room in cab for observer	58
Too busy (too much trouble)	109
Don't want to be bothered	69
Unqualified refusal	113
Other reasons for refusal	137
Security problems	5
No longer business	14
Several contacts and call backs with no response or decision	149
Truck not in category sought at the time	214
Not listed in telephone directory or unlisted number	91
Legal problems	3
Insurance problems	6
Union problems	4
Owner deceased	3
TOTAL	1062

Truck Condition

Even after agreement of the owner was obtained, not all vehicles could be successfully instrumented. Many of the scheduled trucks did not have operating speedometers. In those cases where the malfunction was due to the speedometer instrument or cable, the sensor could be installed directly at the takeoff point. In those cases where the difficulty involved the transmission, the vehicle had to be rejected.

Tires were the next deficiency noted. During chassis dynamometer calibration, two truck tires failed despite extraordinary precautions taken. In one case of a dual rear-tire truck, one tire was noticeably undersized when compared with its mate, throwing most of the wheel load on that single tread. Dynamometer calibration was discontinued when this tire evidenced distress. The extreme example, perhaps, was the case where one truck was presented for installation which had only one gear in the transmission operative; it was not surveyed.

Truck condition further reduced the yield of owner contacts and added significantly to the acquisition task. During the latter stages of the survey and prior to the scheduling, the owners were questioned regarding their vehicles condition to prefilter those not suitable.

Chapter 4

TRUCK INSTRUMENTATION

The data acquisition system used included sensors to measure engine RPM, vehicle speed, engine load factor, engine temperature, and throttle valve position; sensor signal conditioning electronics; and, a digital data logger with integral clock and magnetic tape recorder. Manually operated switches were included to enable recording of road type and traffic conditions for subsequent correlation with the sensor data. The above signals, along with time of day from the data logger clock, were sampled and recorded at the rate of one data set every 0.83 seconds.

Major components of the data acquisition system are listed in Table 3. A system block diagram is shown in Figure 1. System configuration for gas, Cummins diesel, and Detroit diesel engines are shown in Figures 2, 3 and 4 respectively.

Data Logger

The central component of the data acquisition system is the Metrodata Model DL620B Data Logger, Figure 5. This unit accepted eight differential data inputs of 0 to ± 1 Vdc, scanned them sequentially, and converted the analog signal to a 16-bit (3 digits plus sign) digital signal. These eight channels, plus two channels of time, pre-parity, and parity bytes, were assembled into a scan which was recorded at a rate of 1.2 scans per second. This digital data was recorded on 4-track, 1/4-inch tape in a BCD complement format at a density of 150 bits per inch. The tape was loaded in a 1200-foot endless loop cassette, which provided 12 hours of continuous recording.

TABLE 3

DATA ACQUISITION SYSTEM EQUIPMENT LIST

Equipment	Quantity	Model/Part No.	Manufacturer
Data Logger	6	DL620B	Metrodata
Quick Rewind	2	QR109	Metrodata
Tape Reader	2	625-3	Metrodata
Position Transducer	2	4046-3	Research, Inc.
Pressure Transducer	5	556	Bourns
Pressure Transducer	1	218-12	Viatran
Magnetic Pickup	3	3040A	Electro-Tech
Speed Transducer (Shaft Encoder)	6	885	Disc Instruments
Speed Transducer (Tach. Gen)	8	---	Spacekom
Position Switch	6	JV5	Microswitch
Thermistor	12	ID751	N. L. Industries
Signal Conditioning Module contains:	5	--	Wyle
-Frequency/Voltage Converter	10	4702	Teledyne/Philbrick
-Power Converter	5	DD12-15B	Power-Mate
-Voltage Regulator	5	LAS2305	Lambda
CRT Controller	1	R2480C	Ann Arbor Terminal
CRT Monitor	1	EVM11	Ann Arbor Terminal

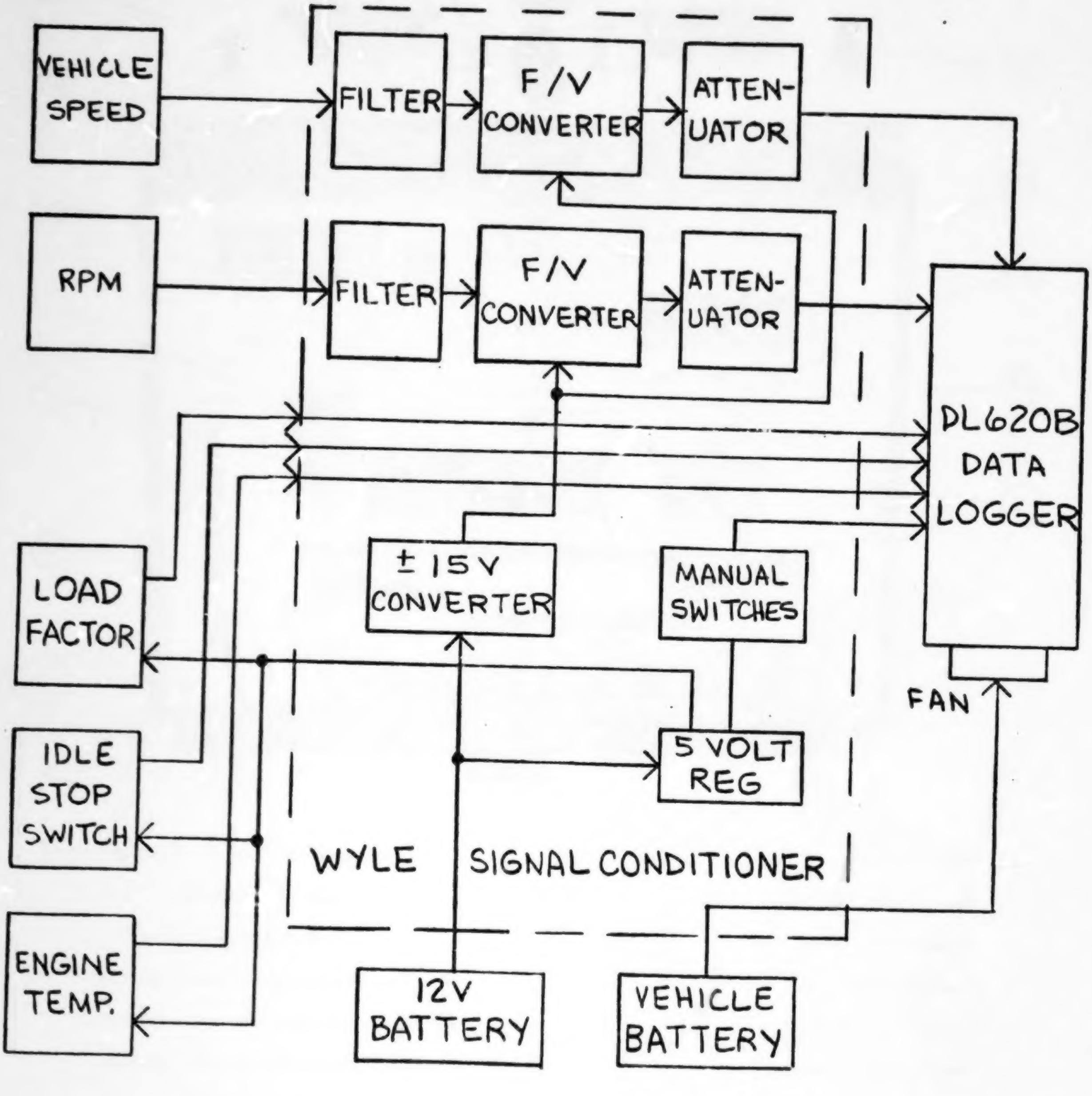
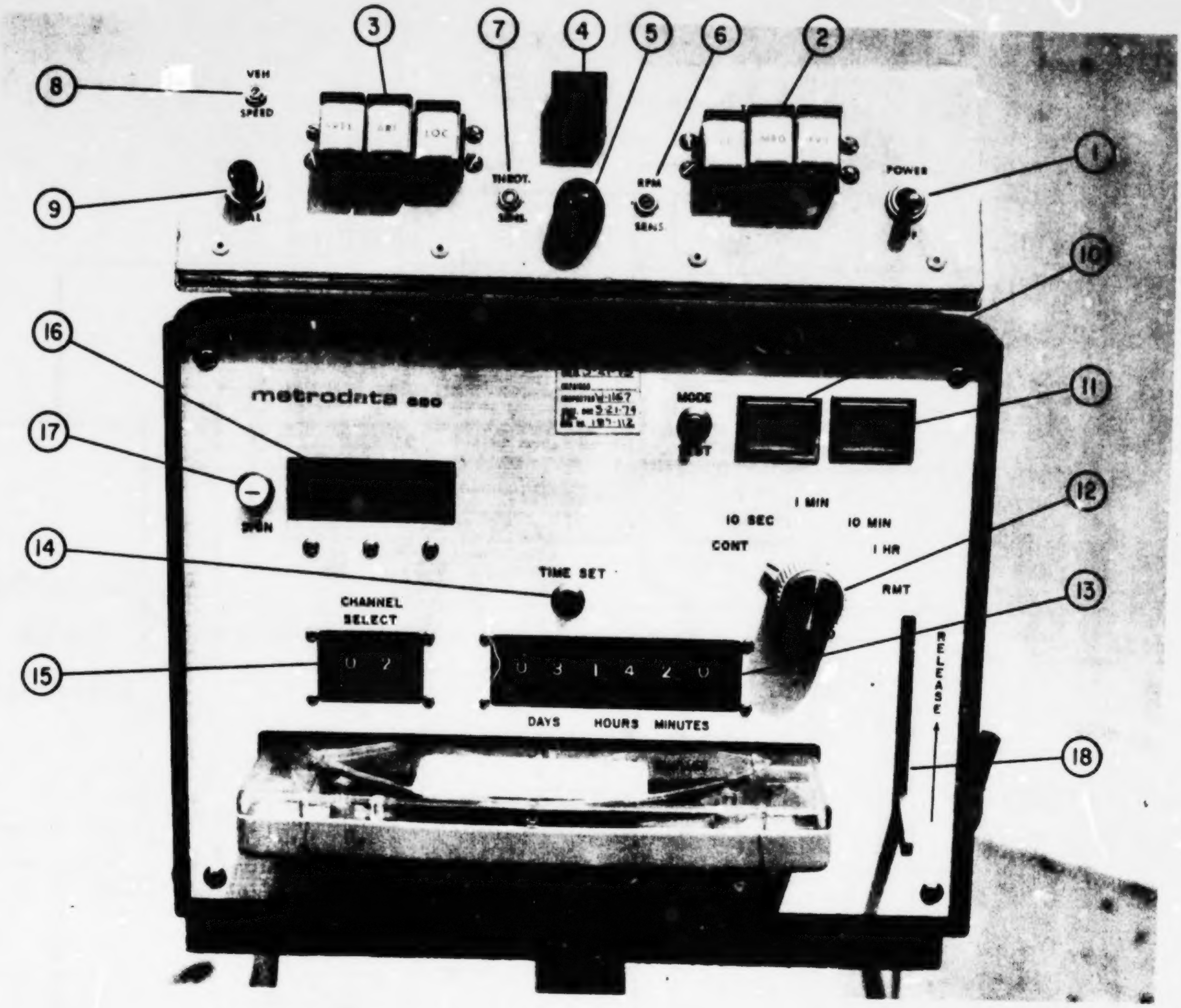

VEHICLE SPEED
FILTER
F/V CONVERTER
ATTEN-UATOR
RPM
FILTER
F/V CONVERTER
ATTEN-UATOR
DL620B DATA LOGGER
LOAD FACTOR
± 15V CONVERTER
MANUAL SWITCHES
FAN
IDLE STOP SWITCH
5 VOLT REG
WYLE SIGNAL CONDITIONER
ENGINE TEMP.
12V BATTERY
VEHICLE BATTERY

Figure 1 Block Diagram - Data Acquisition System


3
7
4
5
6
2
8
VEH
SPEED
1
POWER
9
THROT.
SENS.
RPM
SENS.
10
16
metrodata
11
MODE
TEST
17
SIGN
1 MIN
10 SEC
10 MIN
12
CONT
1 HR
14
TIME SET
RMT
13
CHANNEL
SELECT
15
RELEASE
DAYS
HOURS
MINUTES
18

1. System Power
2. Manual Input – Traffic
3. Manual Input – Road Type
4. Power Indicator
5. 5 Amp. Power Fuse
6. RPM Sensitivity Adjust
7. Load Factor Sensitivity
8. Vehicle Speed Adjust
9. Inverter Power Fuse
10. Illuminated Power Switch
11. Illuminated Mode Switch – Standby/Record
12. Record Rate Switch (locked)
13. Thumbswitches to set Real Time
14. Time Reset Button – Starts Real Time
15. Channel Select – Displays in Item 16
16. Channel Data Display – 3-Digit + Sign
17. Polarity Display – Lights on (-)
18. Cassette Release Lever
19. Mode Test Switch

FIGURE 2
DATA ACQUISITION SYSTEM

Front panel controls on the Data Logger included the POWER switch, Analog Display with CHANNEL SELECT switch, and TIME SET controls. Time was displayed on Channels 1 and 2 in the same manner as other channels. The channel format for all tests is listed in Table 4.

Signal Conditioning Module

Signals from the transducers were fed into the Wyle-built Signal Conditioning Module. The Signal Conditioning Module provides interfacing and signal conversion between transducers and data logger.

Power Supply

A separate 12 Vdc battery powered the data acquisition system, and is controlled by a front panel switch. An indicator switch shows system power status.

Road Type and Traffic Conditions

Manual inputs for road type and traffic conditions were programmed by two sets of switches on the front panel operated by the observer. The switches were interlocked to prevent selection of more than one condition. These switches were push-button type and established normal voltage of either + .86, - .86, or 0 volts corresponding to the condition entered, and is so recorded on the tape in digital form.

TABLE 4
CHANNEL ASSIGNMENTS DURING CALIBRATION

Channel No.	Measurement
1	Truck No. and Time
2	Time (hours units and minutes)
3	Engine RPM
4	Load Factor
5	Vehicle Speed
6	Road Type
7	Traffic Conditions
8	Slow Idle Position
9	Engine Temperature
10	Dynamometer H. P.(Calibration only) Otherwise, Vehicle Speed (Zero reference on survey tapes)

Vehicle Speed

The input signal for vehicle speed was an AC signal from either a tachometer generator (on the first 15 trucks) or a Disc Instrument Shaft Encoder. The voltage of the tachometer generator or the frequency of the encoder was proportional to vehicle speed.

A recurrent problem with vehicle speed shaft encoders producing an output when the vehicle was not in motion was experienced during the second portion of field operations. The problem was addressed by installing an additional speed transducer (Spacekom tachometer-generator type) in the speedometer cable drive. The output from this transducer was connected to Channel 10 on the data logger to indicate when the vehicle was stopped. The tachometer generator output was reliably zero when the vehicle was stopped. The presence of a signal from this unit confirmed the validity of the Channel 5 readings.

Engine RPM

The engine RPM input was derived from the ignition coil or a magnetic pickup and was a series of pulses with a dc level of 0.5 to 6 volts and a frequency proportional to RPM. The resultant pulse train is converted to a dc signal proportional to input frequency by a converter, and adjusted to a scale factor approximately 0.1 V/1000 RPM.

An alternate RPM input to the Signal Conditioner is provided for use with speed transducer on vehicles with mechanical tachometers. For Diesel engines which had a mechanical tachometer drive, engine RPM was measured by tach-generator. Disc I instrument shaft encoder transducers were also used for diesel engines with mechanical drive; however, their use was discontinued due to occasional output signal when the engine was stopped.

Load Factor

Load factor was determined as wheel horsepower, calibrated on a chassis dynomometer, as opposed to clutch plate or net horsepower. Wheel horsepower was correlated to appropriate engine operating parameters during calibration.

Other means of obtaining load factor were considered. Torque cell installation on the drive train was considered and rejected because of field installation problems and tendency to oscillate under actual road transient conditions. Further, drive train modifications would have to be tailored to each truck. This was not compatible with field operations with limited installation times. The load factor technique utilized considered the most compatible and suitable way to determine wheel horsepower in field operations.

The problem of conversion of wheel horsepower to engine net horsepower as required for engine cycle development was recognized early in the program. The wheel horsepower does not reflect drive train losses which occur between clutch plate and wheel. This conversion to engine horsepower from measured wheel horsepower was not within the scope of this survey.

Load factor signal sources were pressure transducers for gasoline and Cummins diesel engines, and a displacement transducer for Detroit diesel engines and those employing a Bosch fuel injection system.

Gasoline Engines - The engine load factor for gas engines was obtained using a Bourns Model 556 Pressure Transducer with a range of 0 to -15 psig to measure intake manifold pressure. The unit was mounted on the inside of the signal conditioning box. The transducer connected to the intake manifold with a section of 1/4-inch automotive vacuum tubing approximately ten feet long. A snubber valve was placed in the vacuum line to protect the transducer from damage.

Detroit Diesel Engines - The engine load factor for Detroit diesel engines was obtained from rack position using a Research, Inc., Model 4046-3 Linear Displacement Transducer.

Cummins Diesel Engines - The load factor transducer for Cummins diesel engines was a 0 to 300 psia pressure transducer measuring rail pressure at the fuel pump outlet. The transducer used was a Viatran Model 218-12 strain-gauge type.

Bosch Injection System - On engines using this system, principally those of International Harvester production, the load factor was measured in a fashion similar to Detroit Diesels. The displacement of a rod controlling the effective stroke of injection plunges was sensed employing a linear displacement transducer.

Throttle Valve Closure

A microswitch, installed on the carburetor, was used to sense closed throttle condition. This generated step function voltage input to the signal conditioner to be recorded in Channel 8 to indicate "curb" idle or closed throttle deceleration conditions.

Engine Temperature

To sense engine temperature, a thermistor unit, type ID751 (National Laboratories Industries) was clamped to the coolant output header as close to the engine as possible. This unit provided a scaled analog voltage proportional to coolant temperature.

Auxiliary Equipment

Two processing equipment groups were available to the Field Survey team. One equipment provided a "quick-look" capability to field personnel, permitting a preview of the 1/4-inch cassette data for field acceptance and to provide equipment malfunction analysis. The second processing equipment group provided the facility to translate the 1/4-inch cassette data to 1/2-inch, machine compatible, raw data tapes.

"Quick-look" Capability - "Quick-look" evaluation of data in the field was accomplished by using a Metrodata model 624-3 tape reader in conjunction with an Ann Arbor Terminals Model R2480C CRT display. The two units were interfaced with a conversion module made by Wyle Laboratories to convert the BCD format of the 1/4 inch cassettes to ASCII format required by the terminal.

The use of the quick-look system in the latter stages of field operation resulted in the detection of vehicle speed error problems which occurred only a small percentage of the time. Numerous other problems were discovered which otherwise may not have been detected until later in the data processing. There were no cases of tapes being accepted on the quick-look system which subsequently turned out to be unacceptable.

Tape Conversion Equipment - Field tapes were read at Wyle-Hampton on a Metrodata Model 625-3 Tape Reader which processed at 12-hour tape in approximately 45 minutes. The data output was parallel 4-bit BCD, and was interfaced directly into a Varian OMI 620 Computer for data reformatting. Computer compatible 1/2-inch tapes, termed Translated Tapes, were generated.

Pre-Qualification Test

In order to demonstrate the functional integrity of the system as a whole, a simulated test was run at Wyle-Hampton prior to the field operations.

Gas engine and diesel engine trucks were rented locally, and the system was installed exactly as planned for field test operations. The test vehicles were operated in the local area to accumulate operating data and experience. These tapes were cycled through the data reduction cycle to yield a complete system and process verification.

An assortment of trucks were instrumented for purposes of testing, evaluation, verification, and demonstration. They included:

- Wyle (Cheverolet 6 Van)
- Ryder (International V8 Van)
- Ryder (Tractor with Cummins 6 engine)
- Leaseway (Tractor with Cummins 6 engine)
- Avis (Tractor with Cummins 6 engine)
- EPA (Ford V8 Van)
- Wyle (Ford V8 Station Wagon)
- U-Haul (Ford V8 Van)
- Ryder (International V8 Van)
- Leaseway (Tractor with Cummins 6 engine)

Field Installation

Detailed description of the field installation is provided in Appendix F. It is significant to note here that one installation was exactly the same as any other. Brackets, braces, and cabling had to be custom-tailored to fit each vehicle. A typical installation of the data acquisition system is shown in Figure 3.

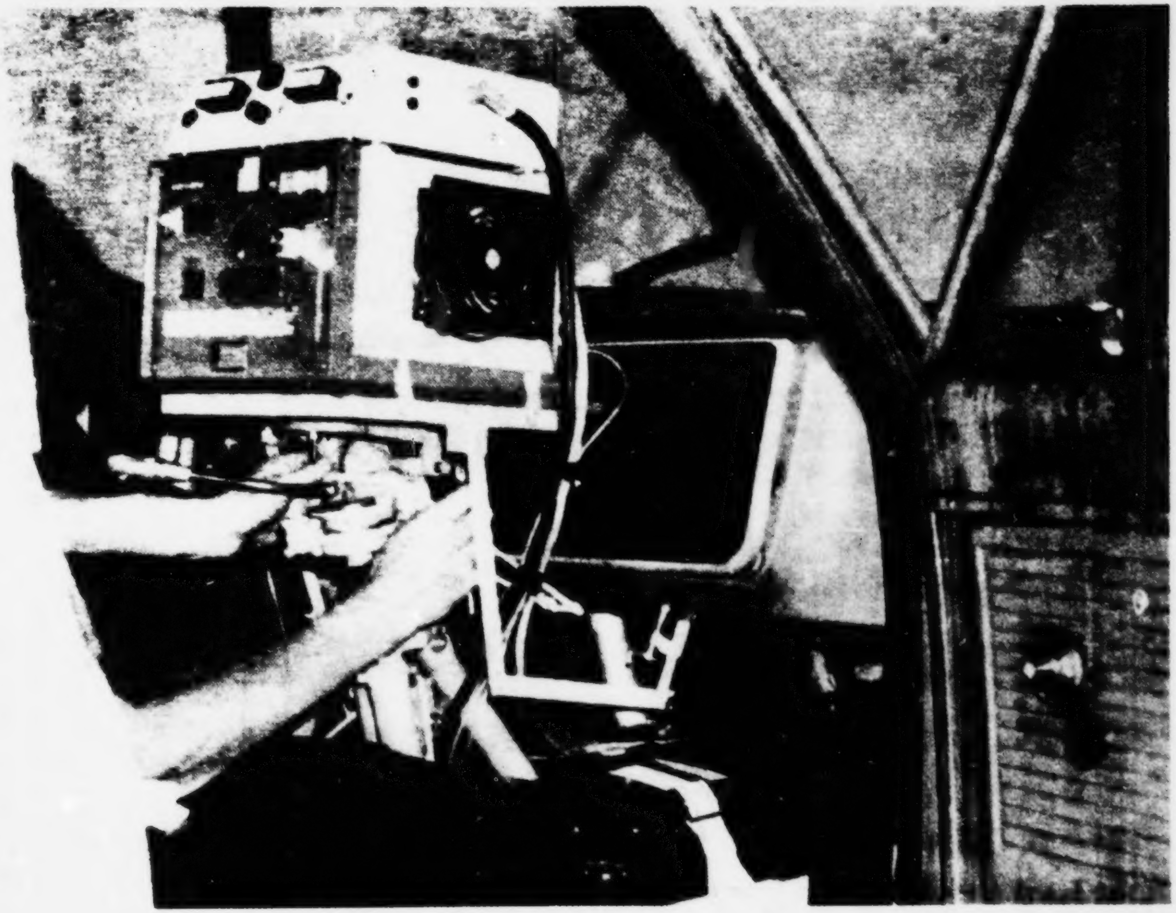
Field Calibration

After installation, the sensors had to be calibrated. Preceding the calibration, all tapes were run-in for approximately 15 minutes to give the cassette an opportunity to adjust to the logger. This run-in was identified by an input of 00 in the truck number location of Channel 1.

Engine RPM - In order to calibrate engine RPM, it was necessary to use a function generator to achieve precise results. The span was adjusted to give an indication on Channel 3 display of ten percent of the true RPM. A frequency equivalent to 5000 RPM was inserted into the equipment input and on Channel 3. As a further check, the engine was run at a speed of 2000 RPM as indicated on a G.R. Strobotac and the Channel 3 display value verified to read 200 ± 2. Any discrepancy was corrected at this time. Calibration points were taken at 0, 1000, 2000 3000, 4000, and 5000 RPM. This calibration was performed after system installation at the buildup area.

Vehicles using a disc instrument shaft encorder or Spacekom tachometer generator were calibrated the same way except the frequency input was proportional to the RPM cable drive gearing. In this case, the frequency-to-RPM relationship was determined by measuring engine speed with a Strobotac.

TRUCK DRIVING PATTERN AND USE SURVEY



Typical Truck Installation of Survey Instrumentation

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FIGURE 3

Engine Temperature - Prior to securing the thermistor assembly to the engine, calibration points were logged at ambient temperature and with the assembly immersed in boiling water.

Vehicle Speed - The vehicle was operated on the dynamometer, unloaded, at 50 mph, and the vehicle speed output adjusted to read 500 counts. Calibration points were logged at 4 speeds up to 50 mph. A 60 Hz electrical calibration was also performed and the reading logged for field verification.

Load Factor Sensor Calibration - The sensors were calibrated prior to installation as follows:

Gas Engines - Manifold pressure transducers were calibrated by using a vacuum pump and calibration gauge to known input pressure points of 21, 14, and 7 inches of mercury. These points and ambient were entered on the calibration log.

Cummins Diesel Transducers - Rail pressure transducers were calibrated with a pressure source (bottled N_2) and calibration gauge at pressures of 0 and 200 psig in 40 psig increments. Calibration points were entered on the calibration log.

After sensors were installed on Detroit Diesels and those using Bosch Fuel Injection systems, they were spanned to range adequately the rack position extremes. The rack was manually moved over its full travel to define end points. Readings for these end points were entered on the Calibration Log. Transducers were calibrated for linear travel of 0 to 1 inch in 1/4-inch increments with reading entered on a calibration log.

Load Factor Dynamometer Calibration - The survey vehicle was operated in high gear on the dynamometer with the data system operating. Load factor, RPM, and dynamometer horsepower from the Clayton control panel were recorded on the calibration tape. During the load factor calibration procedure, ROAD TYPE selector was placed in FREEWAY position during adjustment phases. When the stable point corresponding to logged conditions was reached and data for this selector was placed in the LOCAL position and left in that position during stable conditions. The selector was returned to FREEWAY position before proceeding with setting the next calibration condition. In this way, logged conditions could be identified with taped data on the calibration tape.

The following was the calibration procedure used in the final stages of the field survey:

"Maximum" Power Curve - The "maximum" power curve was determined by taking full power readings at increasing RPM increments until the peak was reached or the governor limited engine speed.* Engine speeds were selected to cover the individual engine's operating range in roughly equal increments.

"Minimum" Power Curve - The "minimum" power curve was determined by taking readings with clutch disengaged and with engine speeds corresponding to those in the "maximum" power calibration.

---

*This was an objective. In many cases, practical limitations restricted the ability to achieve maximum horsepower at some rpm's due to the nature of the chassis dynamometer operations, tire and engine conditions and extreme concern that permanent damage to owner's engine due to severe test conditions. Judgement was conservatively made on continuation of the activities to prevent such damage.

Intermediate Power Points - Several intermediate power points were taken at each engine RPM interval in quantity necessary to provide at least 30 calibration points.

Plotting of Calibration Points - Calibration data obtained above was plotted on a Horsepower versus engine speed chart to confirm an acceptably smooth transition of points. Points off a smooth transition were rechecked and either confirmed or corrected.

Gear Ratio Calibration - With the vehicle still on the chassis dynamometer, gear ratios were determined by operating the engine at a fixed speed (usually 2000 rpm) and measuring wheel speed and vehicle speed for each transmission and differential gear. Wheel speed was strobed by a G-R Strobotac. Vehicle speed was determined from the speed transducer output which had been previous calibrated.

Daily Equipment Calibration

After each day of survey operation and before equipment is removed, the instrumentation was checked for proper operation. The following items were checked:

Engine Speed - Engine RPM readings were logged at engine-off and at idle. A 60 Hz test signal was injected into the signal conditioner input to ascertain that no sensitivity changes had occurred. If a change greater than five counts for the 60 Hz calibration was noted on the data readout, the Instrumentation Supervisor was notified immediately.

Vehicle Speed - Vehicle speed was checked with a 60 Hz test signal. A change greater than five counts was noted, the Instrumentation Supervisor was notified immediately.

Engine Temperature - The temperature channel was observed for normal readings and proper direction of travel with changing temperature. The Instrumentation Supervisor was notified of any discrepancies. Corrective action was taken if these checks exceeded the tolerances.

Data Quality Control

In order to allow for corrective action in the event of data problems, it was imperative that data cassettes be evaluated in a timely manner. Tape cassettes and log sheets were shipped by Wyle-Hampton via Greyhound bus after a "quick-look" verification in the field. Following transcription in Hampton, the 1/2-inch "raw" data was shipped to WSA in Columbia, S.C. via Piedmont Airlines Priority Express Package (PEP) service.

Quick-Look Data Evaluation - Quick-look data evaluation was accomplished by reading the cassettes on a field reader and outputting the data to a CRT display. During playback, the CRT display was monitored for proper signals in the data channels. A dual trace oscilloscope was utilized to monitor skew and jitter.

Pre-installation Equipment Test - The "quick-look" capability was also employed to check performance of a data acquisition system after its removal from a survey truck installation and before reinstallation in another truck. Each system was checked for proper operation using the "quick-look" equipment, as follows:

- Installed a special five minute cassette in the data logger.
- Put standard voltages or conditions on each input channel.
- Recorded these conditions on the cassette for approximately 4 1/2 minutes.

- Observed recorded results on CRT Display to see that all standard data has been recorded without error.
- Serviced as necessary any malfunction.

Instrumentation Summary

Survey trucks in New York City had instruments installed for a total of 315 days. During this period, 166 acceptable truck-days of data were generated in which acceptable horsepower calibration models were generated. An additional 21 truck-days of data were developed on trucks for which the horsepower model was not acceptable. Two of these were not processed due to reasons cited above. During the period, 9 truck-days were not obtained due to tape jam problems, 15 truck-days were not accepted due to faults in the Metrodata Data Logger, 12 days were not accepted due to transducer failures, 12 tapes were unreadable for various other reasons and 11 truck-days were rejected for other reasons. On 69 days during the installed period, the owner did not operate the truck. A summary of these experiences by truck number is shown in Table 5.

Additional Instrumentation Problems Encountered

During the 1974 field survey operations, several problems developed as follows:

Data Logger Power Supply - An epidemic of power supply failures (transistor Q103) occurred early in July, 1974. Immediate action was taken to modify failed units in the field and an engineering analysis was undertaken to determine a more permanent fix.

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Table 5

INSTRUMENTATION MAINTENANCE SUMMARY

Truck No.	No. Days Installed	Good	Tape Jam	Logger Malfunction	Did Not Go Out	Transducer Malfunction	Other	Un-readable	HP Model Not Accepted
1									
2	3	2			1				
3	3	2				1			
4	6	5			1				
5	4	3						1	
6	3	2			1				
7	2	2							
8	4	3			1				
9	6	5			1				
10	4	3			1				
11	4	3			1				
12	3	3							
13	7				2				5
14									
15	2							2	
16	9	4			3		2		
17	7	3			2			2	
18									
19									
20	4	4							
21	5							5	
22									
23									
24									
25	3	3							
26	7		2						5
27	10	2		2	4	2			
28	5	4			1				
29	9	3	1	4	1				
30	5	3			2				
31	5	5							
32	6	3	1	1		1			
33	9	1	2		2	2	1	1	
34	14	5			9				
35	8				4				4
36	5	5							
37	2	2							
38	7	4		2	1				
39	7	4	1	1				1	
40									
41									
42	4						1		3
43	15	4			9	1	1		
44	10	5		1	4				
45	6	5					1		
46	2				1		1		
47	5	3			2				
48	9			4	1				4
49	7	5					2		
50	6*	5*							
51	6	4					2		
52	4	4							
53	11	5	1		5				
54	4	4							
55	6	3			3				
56	7	4			1	2			
57	2	2							
58	7	5	1			1			
59	2	2							
60	3	3							
61	3	2				1			
62	5	5							
63	4				4				
64	7	5			1	1			
65	2	2							
70	1*	1*							
	315	166	9	15	69	12	11	12	21
[illegible]									
80	[illegible]	3						2	
81	[illegible]	5							
82	3	2						1	
83	7	4		1		2			
84	[illegible]	1	2			1		2	

*Indicates truck 50 had 6 good days of data - day 2 was extra therefore was processed as Truck 70

Temporary modifications in the field to eliminate a suspected transient problem included installation of diodes across the tape drive motor, addition of capacitive filtering to the tape motor drive circuit, and movement of the crowbar circuit SCR anode to a point which blows the fuse but does not burn the Q103 transistor. Results of the engineering analysis are described in Appendix F. Following the field survey in New York, all Metrodata Loggers were permanently modified as described.

Vehicle Speed Transducer - Recurring problems were experienced with output signal from Disc Instrument transducers with no rotation. The use of a suppression circuit in the circuit was rejected because it might introduce undesirable lag or other problems. The solution finally utilized for vehicle speed was to use a tachometer on channel 10 and the Disc Instrument transducer on channel 5. Channel 10 was then used as a zero reference only during the subsequent data processing.

Post-Survey Activities

At the conclusion of the New York test program all equipment was returned to Wyle-Hampton, calibrated and refurbished. The calibrations were compared to those done prior to field operations and no significant changes were noted.

The signal conditioner modules have been redesigned and completely rebuilt to formally incorporate changes in transducer types and calibration methods which evolved during program performance. The new features include switch combinations allowing selection of three types of load factor transducers and four types of RPM sensors. A switch and variable resistor have been added to correct vehicle speed output on trucks with two-speed rear axles. This observer-operated switch allows calibration in both ranges and ensures proper speed readings at all times.

The Metrodata Data Loggers were permanently modified with the incorporation of changes described in Appendix G.

Chapter 5

SURVEY OPERATIONS

After the survey truck had been instrumented and calibrated, the vehicle was returned to the owner. Each day thereafter a Survey Observer reported to the truck and rode with it during its normal operation.

During this period, the observer performed three major functions:

- Entered into the instrument keyboard the roadway type and traffic conditions.
- Performed operational checks on the equipment and logged the results.
- Maintained an Origin-Destination Log.

Operation Log

Instructions required the observer to ripple through the CHANNEL SELECT thumbwheel switches on the data logger and read corresponding data in the read-out window of the logger. These data were recorded on a log sheet provided. The observer judged whether these readings were reasonably reflecting the operating conditions of the vehicle based upon nominal values provided him. If they did not, he entered appropriate comments on the log. In cases of serious malfunction, he reported the unsatisfactory conditions immediately to the Field Survey Director. These operational checks were for maintenance purposes and were reviewed daily by a technician during his servicing of the instrumentation. A copy of the detailed instructions is included as Appendix H.

Origin-Destination Log

In addition, the observer maintained a log of the origin and destination of each trip. This procedure was initiated during field survey operations in 1974 beginning with Truck number 25. A transcript log form and instructions for these logs and a summary of Survey 0-D logs are given in Appendix H.

In this log, the origin of one trip normally was the destination of the previous stop. These locations were defined as the major intersection nearest the actual point to avoid recording exact names or adresses of the shipper/consignee. The latter would have been objected to by a number of operators who felt that such data was proprietary.

The percent visible load shown in the O-D summary was a judgmental factor determined by observer.

Chapter 6

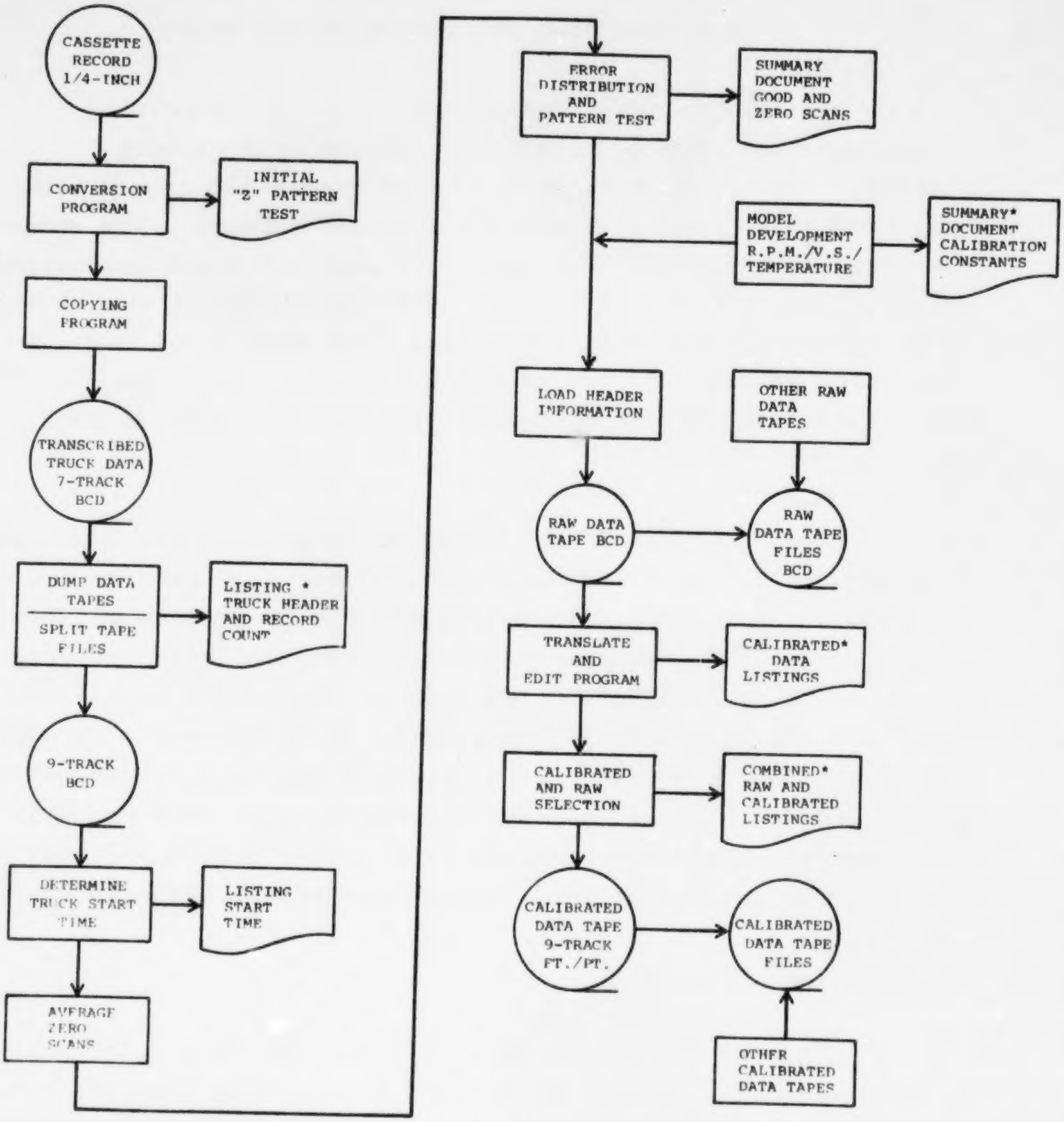
DATA REDUCTION AND PROGRAM DEVELOPMENT

The original data analysis portion of the Driving Pattern and Use Survey-Phase II, consisted of four work elements. The first element was the conversation of raw data cassette tapes, into manageable and useful formats. The second element aggregated this raw data into real units and determined its significant characteristics. The third element was intended to statistically assemble these data into meaningful formulations that described truck patterns and uses. The final element was intended to mathematically combine these truck days and stratifications.

The objective of this complete processing procedure was to reduce collected field data and analyze truck pattern and operational characteristics. However, due to project modifications, mode verification and reduction programs were not performed on survey data. The calibrated tape in the data file did not translate raw data load factor records to horsepower. Horsepower models and data processing programs developed under this contract are discussed in Appendix D and E respectively. The channel assigned for horsepower contains load factor analog voltage. The flow diagram for the overall data processing is shown in Figure 4.

Raw Data Tape Processing

The creation of raw data tapes in the data file, consisting of a number of steps starting with the field recorded data on cassettes through various validity tests and control evaluation; the translated tape resulted. This tape was edited and became a raw data tape in the data file.


CASSETTE RECORD 1/4-INCH
CONVERSION PROGRAM
INITIAL "Z" PATTERN TEST
COPYING PROGRAM
TRANSCRIBED TRUCK DATA 7-TRACK BCD
DUMP DATA TAPES
SPLIT TAPE FILES
LISTING * TRUCK HEADER AND RECORD COUNT
9-TRACK BCD
DETERMINE TRUCK START TIME
LISTING START TIME
AVERAGE ZERO SCANS
ERROR DISTRIBUTION AND PATTERN TEST
SUMMARY DOCUMENT GOOD AND ZERO SCANS
MODEL DEVELOPMENT R.P.M./V.S./ TEMPERATURE
SUMMARY* DOCUMENT CALIBRATION CONSTANTS
LOAD HEADER INFORMATION
OTHER RAW DATA TAPES
RAW DATA TAPE BCD
RAW DATA TAPE FILES BCD
TRANSLATE AND EDIT PROGRAM
CALIBRATED* DATA LISTINGS
CALIBRATED AND RAW SELECTION
COMBINED* RAW AND CALIBRATED LISTINGS
CALIBRATED DATA TAPE 9-TRACK FT./PT.
CALIBRATED DATA TAPE FILES
OTHER CALIBRATED DATA TAPES

* HARD COPY PRINTOUT FOR DIAGNOSTICS ONLY. NOT AVAILABLE FOR ALL DATA SETS.

OVERALL DATA PROCESSING
FLOW DIAGRAM

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FIGURE 4

Field Data Quality Control - This review procedure was introduced into the program during the 1974 field operations. The procedure was described in Chapter 4, and provided an indication of acceptability of data and proper operation of field instrumentation. In fact, no tape passing this inspection subsequently failed remaining tests and all were acceptable.

Cassette Conversion Program - This program translated the information collected on 1/4-inch cassettes to 1/2-inch 7-track IBM tapes. During this translation, certain checks were made to test the reliability of the data. Primarily these included preparity and parity checks. If there was parity agreement this program would record complete data on the 1/2-inch tape. If these checks failed then the data scan* being translated was zeroed.

Other validity checks performed included the following: (1) verification of the existence of 41 characters between preparity characters; (2) verification that only 10 sign characters exist between preparity characters; and (3) verification that each sign character was followed by three valid data characters. If any one or any combination of the above criteria were not met the entire scan was written on the 1/2-inch tape as zeros. The beginning of the next scan was defined as the first sign character following preparity and the process was repeated.

---

* A data scan is defined as 10 channels of information or 40 characters, equal to .88 seconds.

This program not only translated 1/4- to 1/2-inch tapes, but also summarized the distribution of zero scans in the data. An example of this output is found in Figure 5. A "z" was printed if there were 60 consecutive scans of good data (sixty scans represented one record). If there had been one or more scans zeroed in the record the total number was then listed. For example, Figure 5 indicated that in the first record there were 58 zeroed scans, the second had 4, and the third 1. The next 72 records contained valid data before one scan was zeroed in the 73rd.

The analysis indicated the distribution of zeroed scans throughout the records, and allowed for preliminary judgments to be made on the acceptability of the data. At the end of the transcription process, the total number of scans and the total zeroed scans were printed out by the teletype unit. Figure 5 indicates "34,436" scans and "78" zeroed scans; or an error of 0.23 percent. The "PE O" at the end indicated zero parity errors on the transcribed 1/2-inch tape.

The flow diagrams for the translation programs employed to process raw cassette data to translated tape form, including the preliminary data control and validity analysis is shown in Figure 6.

The sub-routines of this program are briefly described as follows:

. WSA

This routine controls the data transcription portion of the WSA program. Upon entry, all counters used for teletype summary page output are initialized. The truck identification cards are read and processed. Communication between computer and cassette is established, and the program takes and records data on magnetic tape in 900-word records = 60 scans with 15 words per scan.

Figure 5

Casette Conversion - Zero Scan Output

```
Truck 3     Day 2

1
                                                 50
00058
00004
00001
zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
zzzzzzzzzzzzzzzzzzzzzz 0001
zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
zzzzz00001
zzzzzzz00001
zzzzzzzzzzz00001
zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
00001
zzzzzzzzzzzzzzzzzzzzz00001
zzzzzzz00001
00001
zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
zzzzzzzz00001
zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz00001
zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
zzzzzzzzzzzzzzz PE 0
RUN 7
SC 34,436
EC 78
```

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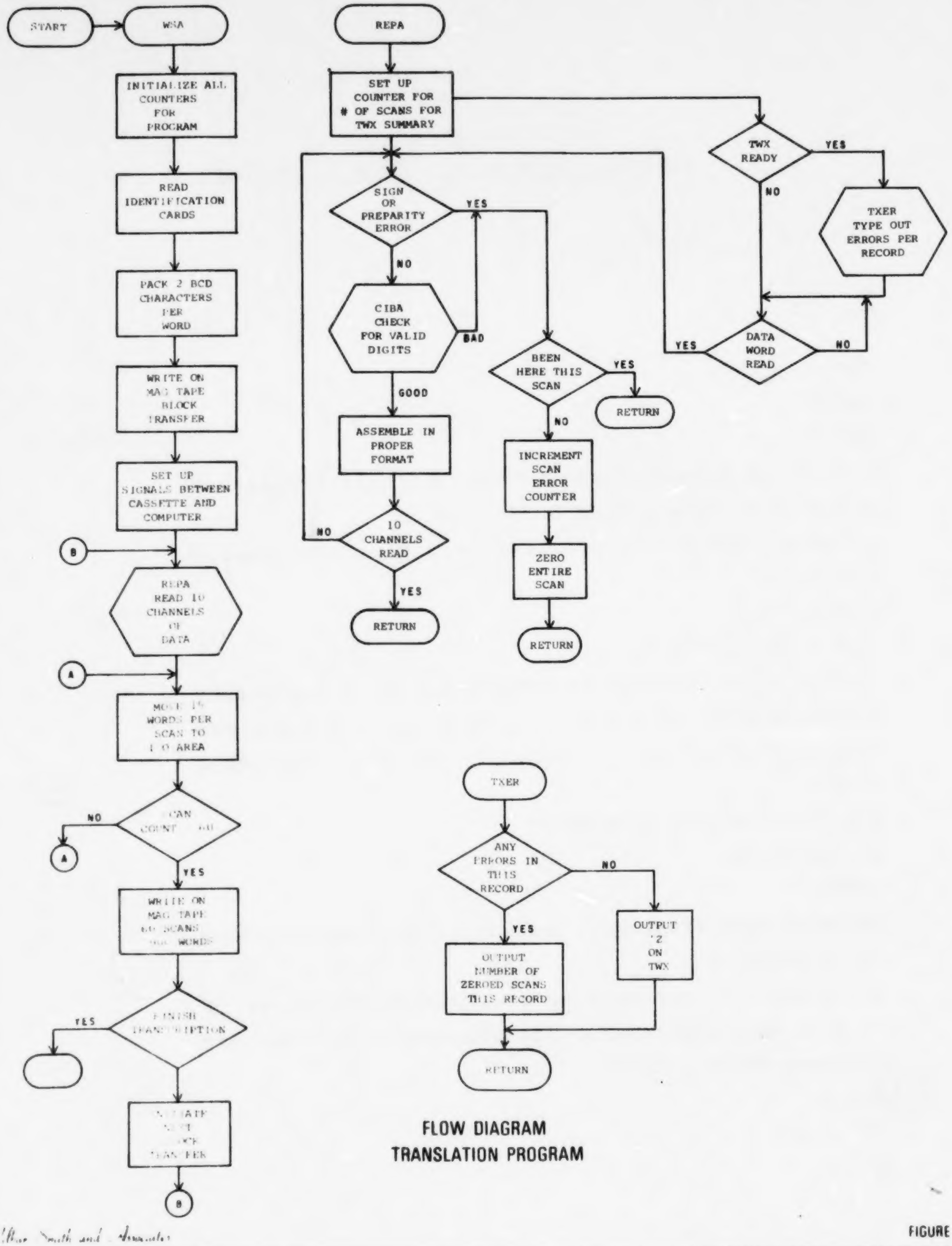
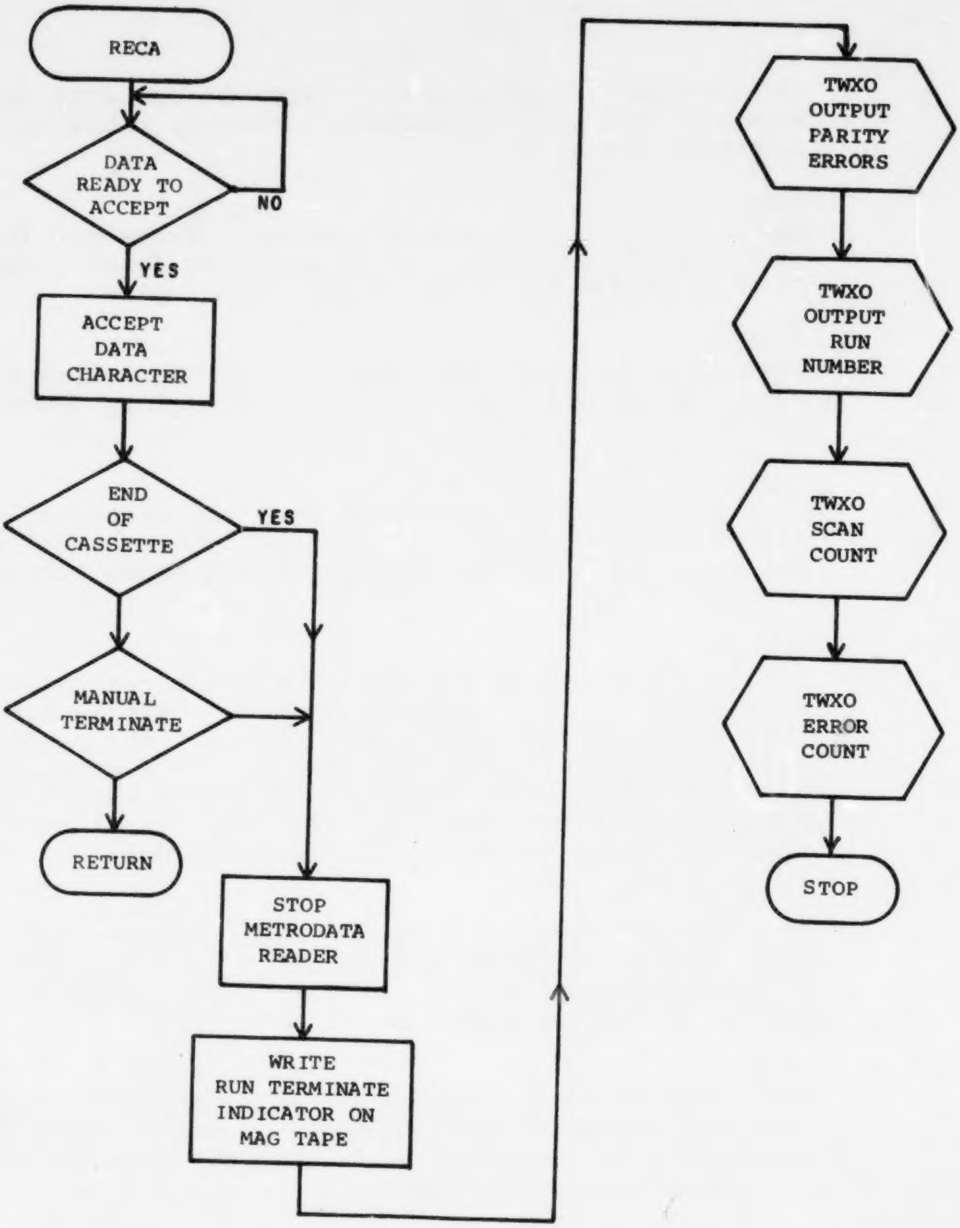

START
WSA
INITIALIZE ALL COUNTERS FOR PROGRAM
READ IDENTIFICATION CARDS
PACK 2 BCD CHARACTERS PER WORD
WRITE ON MAG TAPE BLOCK TRANSFER
SET UP SIGNALS BETWEEN CASSETTE AND COMPUTER
B
REPA READ 10 CHANNELS OF DATA
A
MOVE 15 WORDS PER SCAN TO I O AREA
SCAN COUNT = 60
NO
A
YES
WRITE ON MAG TAPE 60 SCANS 900 WORDS
FINISH TRANSCRIPTION
YES
INITIATE NEXT BLOCK TRANSFER
B
REPA
SET UP COUNTER FOR # OF SCANS FOR TWX SUMMARY
SIGN OR PREPARITY ERROR
YES
NO
CIBA CHECK FOR VALID DIGITS
BAD
GOOD
ASSEMBLE IN PROPER FORMAT
10 CHANNELS READ
NO
YES
RETURN
BEEN HERE THIS SCAN
YES
RETURN
NO
INCREMENT SCAN ERROR COUNTER
ZERO ENTIRE SCAN
RETURN
TWX READY
YES
NO
TXER TYPE OUT ERRORS PER RECORD
DATA WORD READ
YES
NO
TXER
ANY ERRORS IN THIS RECORD
NO
YES
OUTPUT NUMBER OF ZEROED SCANS THIS RECORD
OUTPUT 'Z' ON TWX
RETURN

FLOW DIAGRAM
TRANSLATION PROGRAM

Wilbur Smith and Associates

FIGURE 6


RECA
DATA READY TO ACCEPT
NO
YES
ACCEPT DATA CHARACTER
END OF CASSETTE
YES
MANUAL TERMINATE
RETURN
STOP METRODATA READER
WRITE RUN TERMINATE INDICATOR ON MAG TAPE
TWXO OUTPUT PARITY ERRORS
TWXO OUTPUT RUN NUMBER
TWXO SCAN COUNT
TWXO ERROR COUNT
STOP

FLOW DIAGRAM
TRANSLATION PROGRAM

Wilbur Smith and Associates

FIGURE 6 (Cont'd.)

Upon either cassette end-of-tape, or operator intervention, the program outputs a summary table to the teletype and halts.

- REPA
  This routine, using other routines, reads and formats ten channels of data. If an error is found, routine ZERO is called which zeros the entire scan.

- RCHA
  This routine reads one channel. If the teletype is ready, it also prints the number of errors found in the record.

- RECA
  This routine reads one datum from the cassette. If a cassette end-of-tape, or operator intervention is detected, the routine TERM is called which outputs a summary.

- ZERO
  During the playback process, the Metrodata reader is coupled to DMI 620 computer system. Data is read in four-bit parallel format each time a "data ready" pulse is received from the reader. This data, beginning with the first sign character following the first preparity is buffered scan-by-scan, for output to 1/2" magnetic tape. Validity checks performed.

- TXER
  This routine outputs a "Z" on the teletype when called if no errors occurred during the current record, or a decimal number in the range of 1-60 indicating the number of zeroed scans in this record.

- TERM
  This routine, when entered, disconnects the computer from the cassette and indicates an end of run on the one-half inch magnetic tape. It then outputs the following to the teletype:

    1. Parity errors (for this run)
    2. Run number
    3. Scan count
    4. Error count (number of zeroed scans)

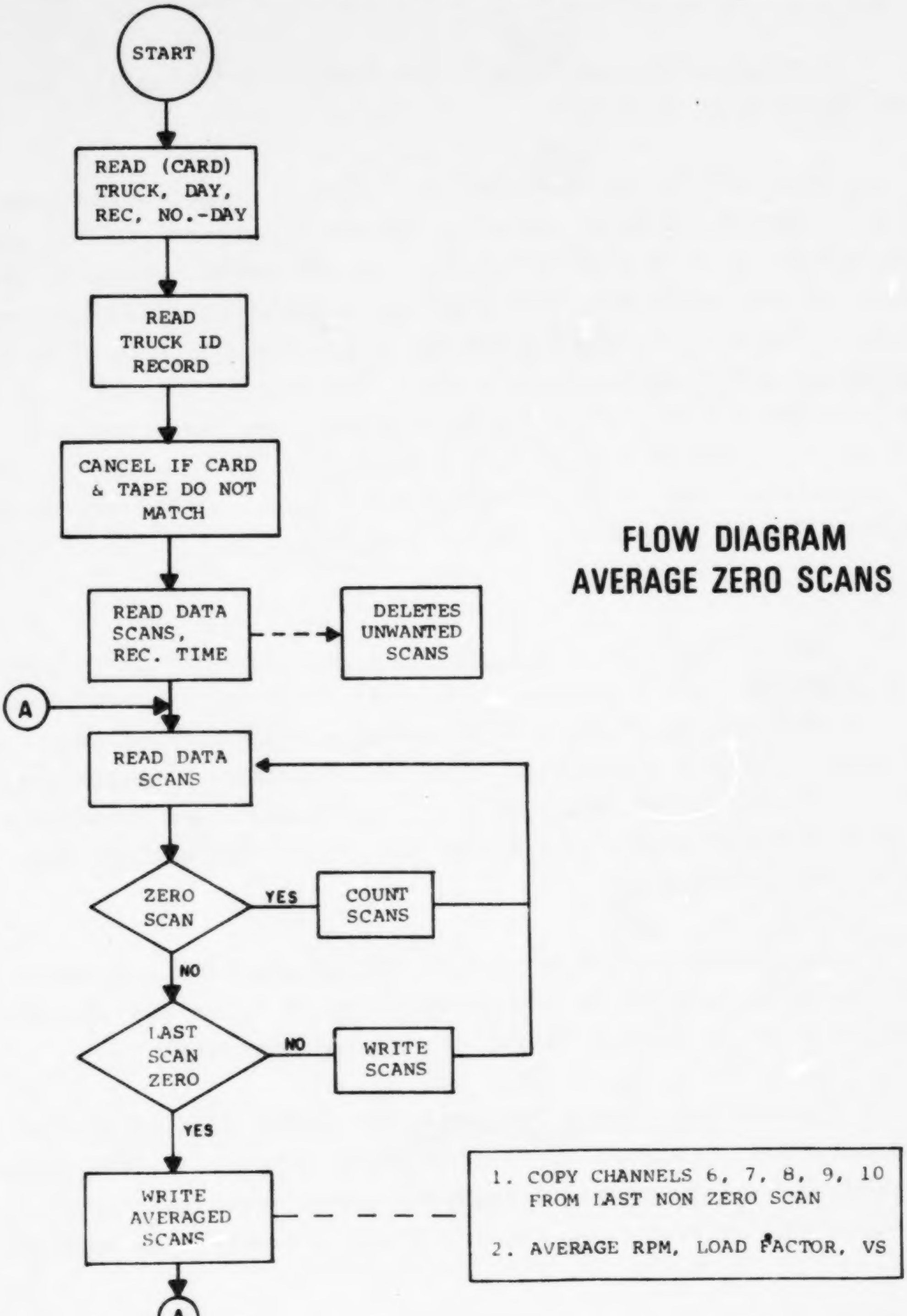
The program then halts, awaiting recycling after the next cassette is entered.

A truck-day of data was preliminary judged acceptable if the transcribed data contained no parity errors and the zero scan count was less than 10 percent of the total. This 10 percent figure is not arbitrary, and a detailed explanation of this can be found in Appendix C, Evaluation and Improvement - Zero Scan Evaluation and Acceptance Criteria. The "Z" pattern test data was only preliminary and a second analysis was run after subsequent edit of the translated tape. The output of this processing produced the translated tape. These tapes were further processed which included the final validity review, editing, and calibration as follows:

Split Tape Files Program, Dump and List Data Programs - These programs were a series of initial processing procedures of the translated tape which were required before further data reduction could be performed. They converted the 7-track data tapes into 9-track tapes, separated the truck files, counted scans, determined start times, and listed the truck headers and any desired raw field data.

The outputs of this initial translated tape breakdown procedure were used to verify readability of tapes and collect information to be used as input for further processing.

Average Zero Scans Program - The first editing of the field data was performed in this program. Basically, the program averaged channel 3, 4, and 5 data for those scans that were zeroed in the initial processing. These channels were averaged


START
READ (CARD) TRUCK, DAY, REC, NO.-DAY
READ TRUCK ID RECORD
CANCEL IF CARD & TAPE DO NOT MATCH
READ DATA SCANS, REC. TIME
DELETES UNWANTED SCANS
A
READ DATA SCANS
ZERO SCAN
YES
COUNT SCANS
NO
LAST SCAN ZERO
NO
WRITE SCANS
YES
WRITE AVERAGED SCANS
1. COPY CHANNELS 6, 7, 8, 9, 10 FROM LAST NON ZERO SCAN
2. AVERAGE RPM, LOAD FACTOR, VS
A

**FLOW DIAGRAM
AVERAGE ZERO SCANS**

Wilbur Smith and Associates

FIGURE 7

based upon the last and the next non-zeroed scan. To identify scans averaged, the truck ID and time (channels 1 and 2) were zeroed.[*] The logic flow of this program can be found in Figure 7. The program also edited the beginning of the truck day if necessary. For example, when a truck was first instrumented there was a brief period of time in which the equipment was warming up, often leading to initial scan errors that end up zeroed under initial scan errors that end up zeroed under initial processing. The "Z" pattern test in Figure 5 showed this; as 58 out of 60 scans were zeroed in the first record. Therefore, these scans were stripped off the 9-track tape by the average program if it occurred prior to the actual start time of the truck as was fed into program from the observer log.

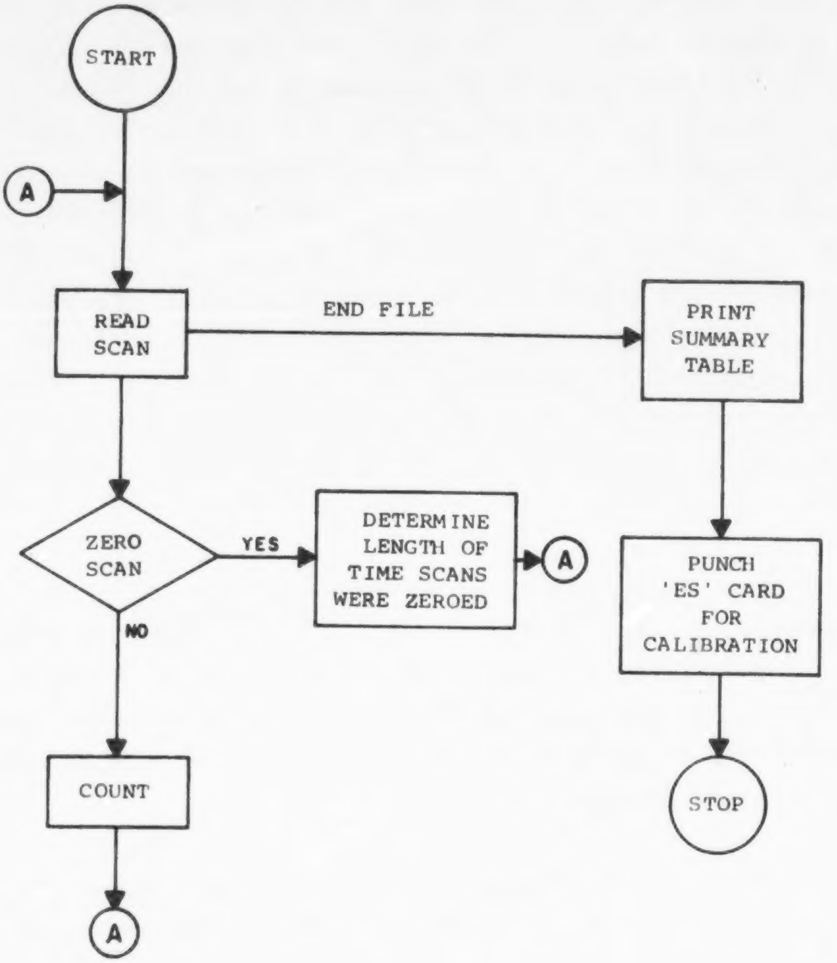
Error Distributions and Patterns Program - Input to this program was the averaged data. The program is designed to determine the total number of scans: total zero scans; total good scans, and their frequency throughout the data. The program also specified consecutive zero scans and the frequencies involved. Figure 8 shows program flow.

Table 6 is an example program output. Here, Bus 81, Day 5 had 35,717 scans read, 483 of which were zero, or an error rate of 1.35 percent.

There were 8 hours 36 minutes and 46 seconds of good

---

[*] Occasionally, truck time contained zeros even though the scan was not averaged; therefore, identification of these scans was not based solely on zeros in the Truck ID and time.


START
A
READ SCAN
END FILE
PRINT SUMMARY TABLE
ZERO SCAN
YES
DETERMINE LENGTH OF TIME SCANS WERE ZEROED
A
NO
PUNCH 'ES' CARD FOR CALIBRATION
COUNT
STOP
A

FLOW DIAGRAM
ERROR DISTRIBUTION AND PATTERNS

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FIGURE 8

TABLE 6

```
                          DATA TAPE SUMMARY
                   SCAN COUNTS AND DISTRIBUTIONS

  TRUCK 81  DAY 5                                    NOVEMBER 5, 1974

          ------- GOOD SCANS -------        ------- ZERO SCANS -------
  SCANS               ------ TIME -----                ------ TIME -----
  READ       SCANS  SECONDS   HH.MM.SS      SCANS  SECONDS   HH.MM.SS      PERCENT
                                                                           ZERO
  25717      25234 31005.92  08.36.46        483   425.04   00.07.05        1.35

 CONSECUTIVE     CORRESPONDING     NUMBER
 ZERO SCANS      TIME - SECONDS    GROUPS

         1               .88          456

         2              1.76           12

         3              2.64            1

         4              3.52

         5              4.40

    6 - 10       5.28 - 8.80

   11 - 15       9.68 - 13.20

   16 - 20      14.08 - 17.60

   21 - 30      18.48 - 26.40

   31 - 40      27.28 - 35.20

   41 - 50      36.08 - 44.00

   51 - 60      44.88 - 52.80

   61 - 70      53.68 - 61.60

   71 - 100     62.48 - 88.00

  101 - 1000    88.88 - 880.00

 1001 - UP     880.88 - UP
```

scans and only 7 minutes, 5 seconds of zero scans. The consecutive frequencies of zero scans were: 456 groups of scans 1 zero long; 12 groups 2 zeroes long; and 1 group of 3 zeroes. The length of time associated with each of these blocks is also recorded. Note that the 12 groups of 2 consecutive zero scans actually represent 24 total scans that were zeroed. The total groups will not equal the total zero scans unless all the groups are found in the first zero frequency.

The tape summary was used as verification of the initial "Z" pattern test. The two would not correspond exactly in scan count or zero count becuase initial scans were stripped from the data by the average program. The primary purpose of the summary was to determine potential reliability of data. If the tape was found to lie within the statistically determined limits of less than 10 percent, the data was defined as "good". Potentially, the data would be a true indicator of the actual truck behavior.

The result of the test of the edited tape is the statistic entered subsequently in the header of the raw data tape. Supplementary output from this program was an error summary (ES) data card which load these data.

Engine RPM, Load Factor, Vehicle Speed, and Temperature Calibration Programs - Survey instrumentation provided voltage outputs which were analog functions of engine rpm, engine load factor, and vehicle speed (mph) developed by proportional sensors installed on the vehicle, recorded in BCD form on the "raw data" tapes. To convert these data to meaningful scales of rpm, hp, and mph, each installation was calibrated under controlled conditions.

Calibration values were converted to mathematical form so that survey data could be translated to engineering terms. The following models were generated from calibration data:

Engine RPM Model was assumed to be linear and of the following form:

RPM = a(x) + b

where:

a and b are calibration constants

x is the analog RPM voltage (Channel 3) output

Calibration values at each engine speed were fitted to this equation form by a least-squares linear regression procedure, and the best values of the constants determined and stored.

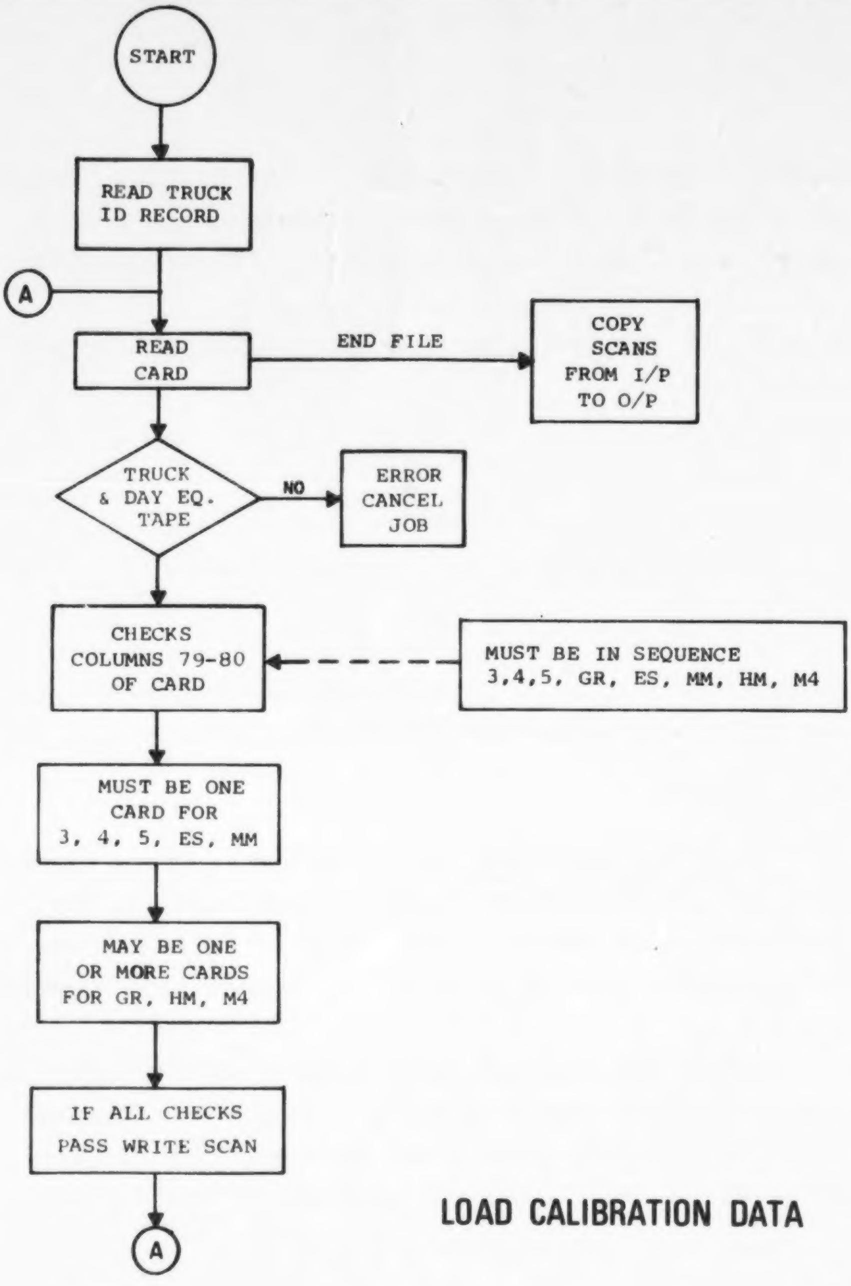
Vehicle Speed Model was generated on the assumption that the sensor output was linearly portional to vehicle speed and passed through origin. The slope of the line was determined by the linear regression program to produce this coefficient.

Engine Temperature Model was generated using the least squares linear regression program. Input data was taken from the field calibration sheets and fed into the program with the resulting output coefficients, satisfying the following equation:

Temp. = A (channel 9) + B

Where:

Temperature is in degrees Fahrenheit.


START
READ TRUCK ID RECORD
A
READ CARD
END FILE
COPY SCANS FROM I/P TO O/P
TRUCK & DAY EQ. TAPE
NO
ERROR CANCEL JOB
CHECKS COLUMNS 79-80 OF CARD
MUST BE IN SEQUENCE 3,4,5, GR, ES, MM, HM, M4
MUST BE ONE CARD FOR 3, 4, 5, ES, MM
MAY BE ONE OR MORE CARDS FOR GR, HM, M4
IF ALL CHECKS PASS WRITE SCAN
A

LOAD CALIBRATION DATA

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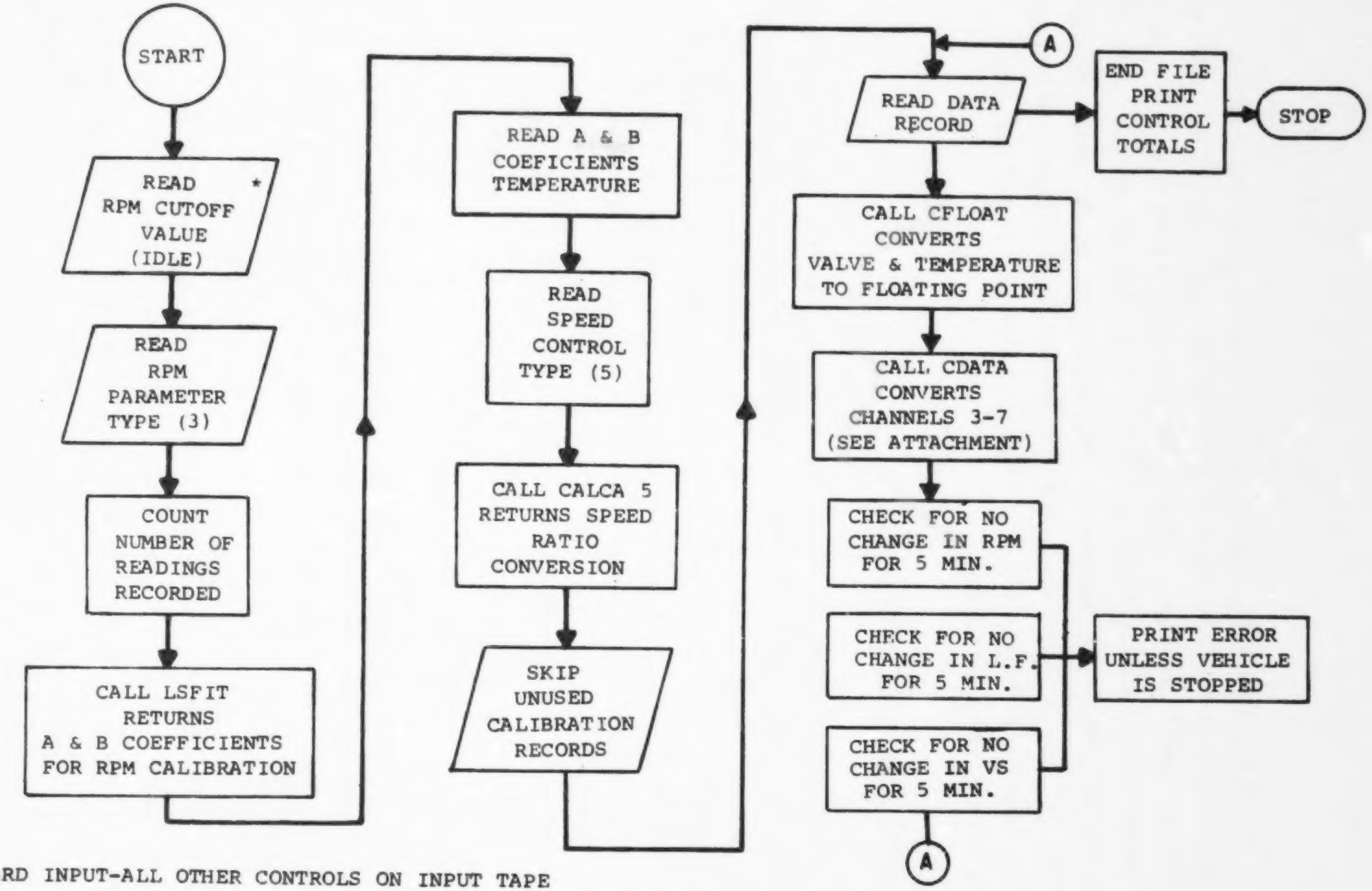
FIGURE 9


START
READ RPM CUTOFF VALUE (IDLE) *
READ RPM PARAMETER TYPE (3)
COUNT NUMBER OF READINGS RECORDED
CALL LSFIT RETURNS A & B COEFFICIENTS FOR RPM CALIBRATION
READ A & B COEFICIENTS TEMPERATURE
READ SPEED CONTROL TYPE (5)
CALL CALCA 5 RETURNS SPEED RATIO CONVERSION
SKIP UNUSED CALIBRATION RECORDS
A
READ DATA RECORD
END FILE PRINT CONTROL TOTALS
STOP
CALL CFLOAT CONVERTS VALVE & TEMPERATURE TO FLOATING POINT
CALL CDATA CONVERTS CHANNELS 3-7 (SEE ATTACHMENT)
CHECK FOR NO CHANGE IN RPM FOR 5 MIN.
CHECK FOR NO CHANGE IN L.F. FOR 5 MIN.
CHECK FOR NO CHANGE IN VS FOR 5 MIN.
PRINT ERROR UNLESS VEHICLE IS STOPPED
A

*CARD INPUT-ALL OTHER CONTROLS ON INPUT TAPE

FLOW DIAGRAM
TRANSLATION AND EDIT PROGRAM

Wilbur Smith and Associates

FIGURE 10

Load Calibration Data Program - This program loaded the truck header containing the RPM calibration points, temperature calibration coefficients, vehicle speed calibration points, gear ratio parameters, error summary data, load factor model, and the horsepower calibration points on the front of each truck day record. Raw data for truck days were then compiled on 14 tapes which provide the Raw Data Tape File. Figures 9 and 10 indicate the logic flow of this program.

Calibrated Tape Data Processing

The next step in data processing was to apply the models developed for engine rpm, vehicle speed and engine temperature to each scan of each truck day file to convert raw data for these parameters to rpm, mph, and degrees Fahrenheit. Data entries on road type, traffic condition and throttle valve closure were coded to standard form. Only the load factor data in Channel 4 remained in raw data sensor form. The data processing utilized one program followed by a quality control program to permit the summary review of the calibration process.

Translate Program - This routine which converted selected BCD data on the raw data tape files to calibrated tape values for rpm, vehicle speed, and temperature is shown in the flow diagram, Figure 11.

In addition to conversion of continuous variables described above, three channels were assigned levels of nominally constant voltages to indicate the 3 road types, 3 traffic conditions and 2 throttle valve positions (channel 6, 7, 8 respectively). Channels 6 and 7 were converted to numbers for future data processing, as follows:

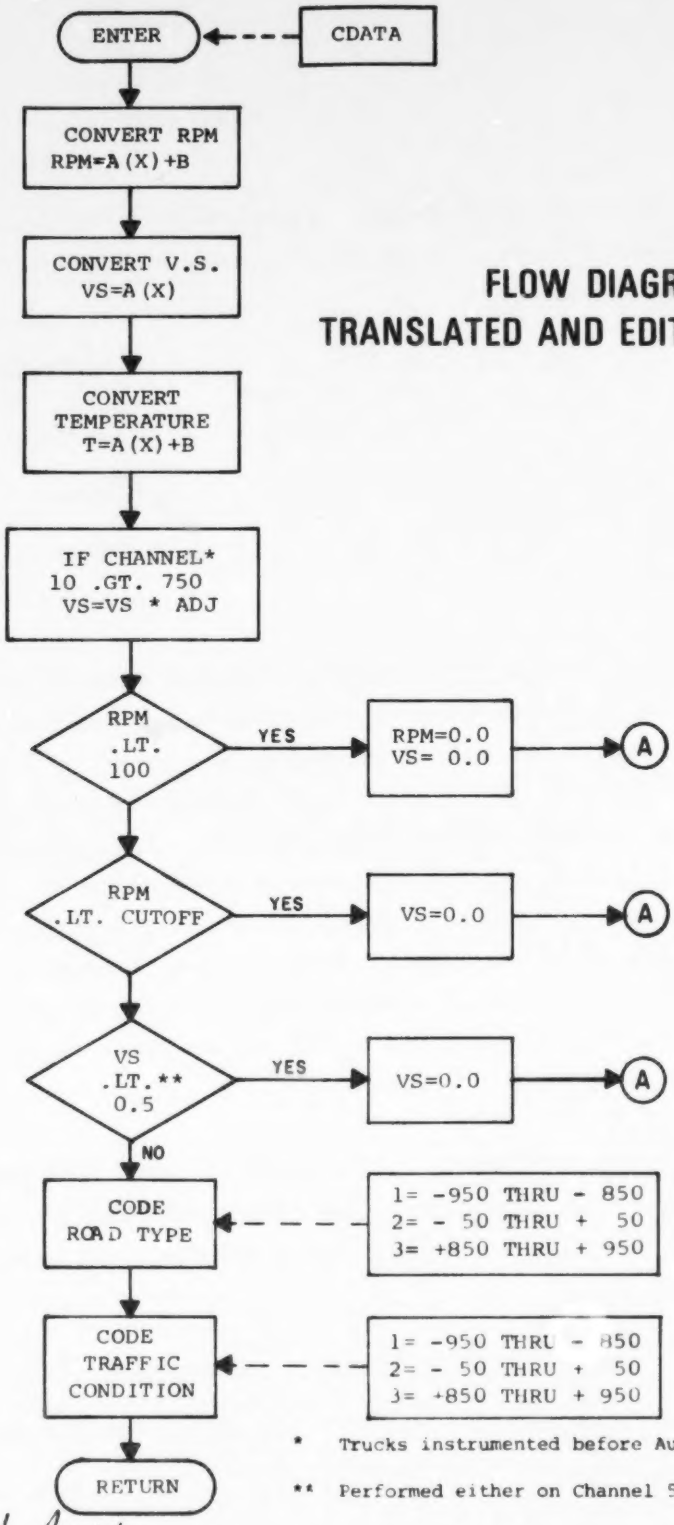
Raw Data Channel Value	Coded Digit on Calibrated Tape Digit	Data Interpretation Channel 6 Road Type	 Channel 7 Traffic
-.900 ± .050	1	Freeway	Light
.000 ± .050	2	Arterial	Medium
+.900 ± .050	3	Local	Heavy

Channel 8 was converted by feeding in the corresponding voltage reading for an open and closed valve condition. If the channel 8 voltage indicated the valve was open, a 1 is placed on the tape and a 0 if it indicates closed. For diesel trucks, there was no measurement of this variable: therefore, channel 8 on the calibrated tape will contain a constant 1. The only channel data that was not altered is channel 4 which contains sensor voltage measurements of load factor. These data were merely converted to the corresponding floating point number. Channel 10 is used to store the R/V ratio which can be used as an indicator of gear changes.

Final Edit Program - In addition to the translation of variables that was performed the final editing of the tape was accomplished in this program. This editing included the following logic checks:

- If RPM was less than 100, the RPM and vehicle speed channels are set to 0.0. Essentially this says that the truck engine was off and there should be no readings in 3 and 5.

FLOW DIAGRAM
TRANSLATED AND EDIT SUBROUTINE


ENTER
CDATA
CONVERT RPM
RPM=A (X) +B
CONVERT V.S.
VS=A (X)
CONVERT
TEMPERATURE
T=A (X) +B
IF CHANNEL*
10 .GT. 750
VS=VS * ADJ
RPM
.LT.
100
YES
RPM=0.0
VS= 0.0
A
RPM
.LT. CUTOFF
YES
VS=0.0
A
VS
.LT.**
0.5
YES
VS=0.0
A
NO
CODE
ROAD TYPE
1= -950 THRU - 850
2= - 50 THRU + 50
3= +850 THRU + 950
CODE
TRAFFIC
CONDITION
1= -950 THRU - 850
2= - 50 THRU + 50
3= +850 THRU + 950
RETURN

* Trucks instrumented before August 10, 1974.

** Performed either on Channel 5 or 10.

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FIGURE 11

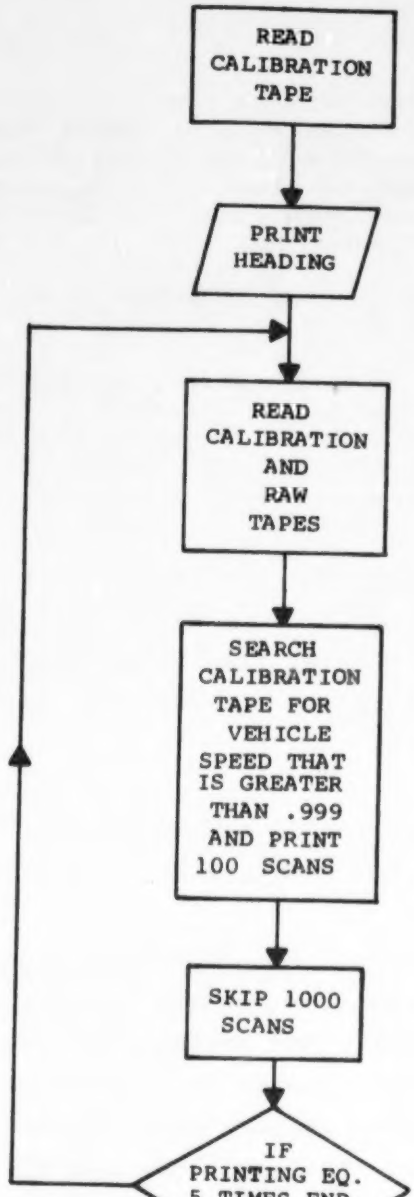
- If RPM was greater than 100 and less than a determined cut-off value, vehicle speed was zeroed. The cut-off point was determined by inspection of raw data and was chosen to allow for the variations in truck idle conditions. This edit check identified a truck operating idle and was conditioned on a corresponding zero speed.
- If vehicle speed (channel 5) was less than .5 mph, then speed was set to zero.
- All trucks which were instrumented after August 10th had a zero speed indicator in channel 10 of raw data indicating 0000 when the truck was stopped. Channel 10 on these records was used as the control variable on vehicle speed. When a zero was detected, channel 5 was also zeroed.

This program also performs a consistency check. For example, if RPM, load factor, or VS remained constant for 5 minutes, as long as VS was greater than 0, an error message was printed and checked. This was to control the possibility of a channel that was stuck.

The result of this program was a 9-track calibrated data tape, in floating point format.

Calibration and Raw Selection Program - This program was designed as a quality control measure to verify manually the calibration, edit, and translation procedure. Figure 12 outlines this logic. Basically, the program printed 100 scans of the raw and corresponding calibrated data at 5 different locations from the truck day. This printout was then visually checked to verify the translation procedure. If any discrepancies were found the raw data tape was reprocessed. This program was proven to be a valuable tool in controlling the data.

Ocassionally auxiliary programs not identified on the flow stream were used to test programs, verify data, etc.


READ CALIBRATION TAPE
PRINT HEADING
READ CALIBRATION AND RAW TAPES
SEARCH CALIBRATION TAPE FOR VEHICLE SPEED THAT IS GREATER THAN .999 AND PRINT 100 SCANS
SKIP 1000 SCANS
IF PRINTING EQ. 5 TIMES END PRINT

FLOW DIAGRAM
CALIBRATION AND RAW SELECTION PROGRAM

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FIGURE 12

These included a plot program that schematically illustrates data characteristics, a program to convert raw BCD data to raw floating point data and a correction program that edited such things as the truck number in the raw data.

Other Programs Developed But Not Applied

During the course of the program, other programs were prepared to further process and analyze these field data. For reasons previously given, they were not applied. For record purposes, they are discussed in Appendices D and E.

Chapter 7

SURVEY DATA OUTPUT

This chapter describes the trucks and buses included in the survey in New York City and relates these to the final sample plan employed. Also given here are the results of data control analyses imposed upon the data collected during field operations, and indicates the accept/reject decisions made on individual days of truck operational data. Contained herein is the identification and cross references between the tapes available in the data file to survey trucks. The detailed format of these tapes is also defined.

Survey Truck Identifications

Trucks in the survey were assigned numbers varying from 1 through 70 and buses from 80 to 84 for control purposes during the truck acquisition effort. Truck days were numbered according to the anticipated acceptability of data for that day, based upon apparent operational status of the instrumentation. Not all numbers so assigned appear in the final survey data file because some trucks were not instrumented, data on others were rejected during subsequent data control analyses and processing, and truck days were not necessarily sequential calendar-wise due to trucks not operating.

Table 7 contains a listing of trucks included in the survey, along with the "base" borough to which it was associated. This was defined as that borough where daily trips originated and usually where they terminated at the end of their operations. The number of sample days assigned to this category of truck by the sample plan is indicated in the next column. Truck descriptors

Table 7

SURVEY TRUCK DESCRIPTION

TRUCK NUMBER	COUNTY BASED	NUMBER OF SAMPLE DAYS	TRUCK TYPE	FUEL TYPE	GVW	INSTALLATION DATE	INSTRUMENT SERIAL NUMBER	TRUCK DAYS - DATES		
								1	2	3
1	NOT INSTALLED									
2	Brooklyn	2	2D	G	16660	8/21/73	188	8/22/73	8/24/73	
3	Queens	3	2D	G	17990	8/23/73	187	8/24/73	8/27/73	*8/28/
4	Manhattan	5	2D	G	13000	8/24/73	186	8/24/73	8/28/73	8/29/
5	Manhattan	4	2D	G	18K	8/24/73	188	8/27/73	8/28/73	*8/29/
6	Brooklyn	2	2D	G	14K	8/27/73	185	8/29/73	8/30/73	
7	Queens	2	TT	G	50K	8/30/73	187	8/31/73	9/4/73	
8	Queens	3	2D	G	17990	9/7/73	187	9/11/73	9/12/73	9/13/
9	Queens	5	2D	G	19500	9/13/73	186	9/17/73	9/18/73	9/19/
10	Manhattan	3	TT	D	N.A.	9/13/73	188	9/17/73	9/18/73	9/19/
11	Brooklyn	3	2D	G	19700	9/19/73	185	9/20/73	9/21/73	9/25/
12	Manhattan	3	2D	G	17820	8/26/73	187	9/27/73	9/28/73	10/1/
13	Manhattan	5	2D	G	N.A.	9/28/73	186	10/2/73	10/3/73	10/4/
14	NOT INSTALLED									
15	Queens	2	2D	G	32,000	10/12/73	187	*10/12/73	*10/15/73	
16	Manhattan	4	2D	G	24,000	10/18/73	186	10/23/74	*10/25/73	10/26
17	Queens	3	2D	G	10000	10/25/73	185	10/25/73	*10/29/73	*10/30
18	NOT INSTALLED									
19	NOT INSTALLED									
20	Manhattan	4	2A	G	10000	11/12/73	186	11/13/73	11/14/73	11/1
21	Manhattan	5	2D	G	10000	11/21/73	185	*11/21/73	*11/22/73	*11/2
22	NOT INSTALLED									
23	NOT INSTALLED									
24	NOT INSTALLED									
25	Bronx	3	2D	G		5/20/74	187	5/21/74	5/22/74	5/23/
26	Brooklyn	5	2D	G	58,900	5/21/74	205	*5/22/74	*5/23/74	5/24/
27	Bronx	3	TT	D	16,450	5/23/74	185, 183, 186	*5/31/74	*6/3/74	*6/4/
28	Queens	3	3A	G	44,860	9/18/74	185	9/20/74	9/21/74	9/23
29	Manhattan	3	2D	G	N.A.	5/28/74	187	*5/29/74	*5/30/74	6/5/
30	Brooklyn	3	TT	G	11,000	5/29/74	188	5/30/74	6/4/74	6/5/
31	Brooklyn	5	2D	G	27,000	6/3/74	183	6/4/74	6/5/74	6/6/
32	Brooklyn	5	2D	G	58,900	8/7/74	183	8/8/74	*8/9/74	*8/12
33	Brooklyn	2	2D	G	24,500	6/5/74	188	*6/6/74	6/7/74	*6/13
34	Manhattan	4	TT	D	50,000	7/3/74	205	7/11/74	7/12/74	7/1
35	Queens	4	2D	G	20,500	6/10/74	187	6/11/74	6/17/74	6/1
36	Brooklyn	5	3A	D	71,000	7/31/74	205	8/1/74	8/2/74	8/5/
37	Brooklyn	2	3A	D	41,040	6/13/74	N.A.	6/14/74	6/17/74	
38	Bronx	4	2D	G	18,500	6/18/74	205	6/20/74	6/21/74	*6/2
39	Manhattan	4	TT	G	39,700	6/17/74	185	*6/18/74	6/19/74	6/20
40	NOT INSTALLED									
41	NOT INSTALLED									
42	Queens	3	TT	D	60,000	6/24/74	183	6/24/75	*6/26/74	6/2
43	Brooklyn	3	TT	D	11,250	7/9/74	186	7/16/74	7/23/74	7/2
44	Manhattan	4	2D	G	10,000	7/17/74	183	7/19/74	7/20/74	*7/2
45	Brooklyn	5	2D	G	58,900	6/26/74	188	6/27/74	*6/28/74	7/1
46	Richmond	1	TT	D	N. A.	7/2/74	188	7/6/74		NOT
47	Bronx	3	2D	D	65,000	8/14/74	186	8/17/74	8/20/74	8/2
48	Bronx	5	2D	G	14,000	6/28/74	186	*7/2/74	*7/3/74	*7/5
49	Brooklyn	5	2D	G	25,500	7/15/74	188	7/16/74	*7/17/74	7/1
50	Brooklyn	5	2D	G	41,970	7/25/74	188	7/29/74	E7/30/74	7/3
51	Manhattan	4	2D	G	16,000	7/26/74	183	7/29/74	3/1/74	8/2
52	Manhattan	4	2D	G	19,500	9/10/74	186	9/11/74	9/12/74	9/1
53	Richmond	5	TT	D	29,000	8/6/74	187	8/7/74	8/8/74	8/9
54	Manhattan	4	3A	D	60,000	9/13/74	187	9/16/74	9/17/74	9/1
55	Bronx	4	TT	D	15,400	8/8/74	N.A.	DNO	8/12/74	8/1
56	Queens	3	TT	D	50,500	8/15/74	187	8/17/74	*8/20/74	*8/2
57	Bronx	2	3A	D	70,000	8/16/74	205	8/17/74	8/20/74	
58	Manhattan	3	2D	D	35,000	9/12/74	205	*9/13/74	9/16/74	*9/1
59	Queens	2	3A	G	44,860	8/21/74	205	8/22/74	8/23/74	
60	Brooklyn	3	TT	D	72,760	8/23/74	186	8/26/74	8/27/74	8/1
61	Brooklyn	3	2D	G	58,900	9/3/74	188	9/5/74	*9/6/74	9/
62	Brooklyn	5	2D	D	32,000	8/27/74	187	8/28/74	8/29/74	8/
63	INSTALLED - NOT OPERATED									
64	Brooklyn	5	TT	G	68,000	8/29/74	185	8/30/74	9/3/74	9/4
65	Richmond	1	TT	D.	50,000	8/29/74	205	8/30/74	9/3/74	
BUSES										
80		3	Bus 4202	D		10/3/73	187	*10/4/73	*10/5/73	10/
81		3	Bus 6201	D		10/12/73	187	10/12/73	10/15/73	10/
82		3	Bus 4454	D		11/2/73	186	11/5/73	11/6/73	11
83		3	Bus 5693	D		11/8/73	183	*11/12/73	11/13/73	11
84	Queens	3	Bus 6227	D		5/21/74	185	*5/22/74	*5/23/74	*5/

(a) Indicates that transcribed tapes for one day each truck were unreadable. Reprocessing was not possible due to the fact that equipment had been returned to the Government.

*BAD DAY

Table 7

URVEY TRUCK DESCRIPTION

RUMENT IAL ER	TRUCK DAYS - DATES 1	2	3	4	5	6	7		Number of Accepted Days
	8/22/73	8/24/73							2
	8/24/73	8/27/73	*8/28/73						2
	8/24/73	8/28/73	8/29/73	8/30/73	8/31/73				5 (a)
	8/27/73	8/28/73	*8/29/73	8/30/73					3 (a)
	8/29/73	8/30/73							2
	8/31/73	9/4/73							2
	9/11/73	9/12/73	9/13/73						3
	9/17/73	9/18/73	9/19/73	9/20/73	9/21/73				5
	9/17/73	9/18/73	9/19/73						3
	9/20/73	9/21/73	9/25/73						3
	9/27/73	9/28/73	10/1/73						3
	10/2/73	10/3/73	10/4/73	10/5/73	10/9/73				5
	*10/12/73	*10/15/73							0
	10/23/74	*10/25/73	10/26/73	10/30/73	10/31/73				4
	10/25/73	*10/29/73	*10/30/73	11/1/73	11/2/73				3
	11/13/73	11/14/73	11/15/73	11/16/73					4
	*11/21/73	*11/22/73	*11/26/73	*11/27/73	*11/28/73				0
	5/21/74	5/22/74	5/23/74						3
	*5/22/74	*5/23/74	5/24/74	5/28/74	5/29/74	5/30/74	5/31/74		5
183. 186	*5/31/74	*6/3/74	*6/4/74	6/11/74	6/12/74	*6/13/74			2
	9/20/74	9/21/74	9/23/74	9/24/74					4
	*5/29/74	*5/30/74	6/5/74	DNO	6/7/74	6/10/74			3
	5/30/74	6/4/74	6/5/74						3
	6/4/74	6/5/74	6/6/74	6/7/74	6/10/74				5
	8/8/74	*8/9/74	*8/12/74	8/13/74	8/14/74	*8/15/74			3
	*6/6/74	6/7/74	*6/13/74	*6/17/74					1
	7/11/74	7/12/74	7/19/74	7/23/74	7/24/74				5
	6/11/74	6/17/74	6/18/74	6/20/74					4
	8/1/74	8/2/74	8/5/74	8/6/74	8/7/74				5
	6/14/74	6/17/74							2
	6/20/74	6/21/74	*6/25/74	6/26/74	6/27/74				4
	*6/18/74	6/19/74	6/20/74	6/21/74	6/25/74	6/26/74			4
	6/24/75	*6/26/74	6/27/74	6/28/74					3
	7/16/74	7/23/74	7/24/74	7/25/74					4
	7/19/74	7/20/74	*7/21/74	DNO	DNO	7/25/74	7/26/74	7/30/74	5
	6/27/74	*6/28/74	7/1/74	7/2/74	7/3/74	7/5/74			5
	7/6/74		NOT CALIBRATED						0
	8/17/74	8/20/74	8/21/74						3
	*7/2/74	*7/3/74	*7/5/74	7/8/74	7/10/74	7/11/74	7/12/74		4
	7/16/74	*7/17/74	7/18/74	7/19/74	7/23/74	7/24/74			5
	7/29/74	E7/30/74	7/31/74	8/1/74	8/2/74	8/5/74			6
	7/29/74	3/1/74	8/2/74	8/5/74					4
	9/11/74	9/12/74	9/13/74	9/16/74					4
	8/7/74	8/8/74	8/9/74	8/12/74	8/21/74				5
	9/16/74	9/17/74	9/18/74	9/19/74					4
	DNO	8/12/74	8/13/74	8/15/74					3
	8/17/74	*8/20/74	*8/21/74	8/22/74	8/23/74	8/26/74			4
	8/17/74	8/20/74							2
	*9/13/74	9/16/74	*9/17/74	9/18/74	9/19/74	9/20/74	9/23/74		5
	8/22/74	8/23/74							2
	8/26/74	8/27/74	8/28/74						3
	9/5/74	*9/6/74	9/9/74						2
	8/28/74	8/29/74	8/30/74	9/3/74	9/4/74				5
	8/30/74	9/3/74	9/4/74	*9/5/74	9/9/74	9/10/74			5
	8/30/74	9/3/74							2
									187
	*10/4/73	*10/5/73	10/8/73	10/9/73	10/10/73				3
	10/12/73	10/15/73	10/16/73	10/17/73	10/18/73				5
	11/5/73	11/6/73	11/7/73						3
	*11/12/73	11/13/73	11/16/73	11/19/73					3
	*5/22/74	*5/23/74	*5/28/74	*5/29/74	*5/30/74				0
									14

ch truck
due to
he Government.

*BAD DAY

according to truck type and fuel type are associated with each survey truck. These descriptors were defined in Chapter 3. The licensed or indicated gross vehicle weight was also indicated.

The table also indicates the date the vehicle was instrumented and the dates on which data were collected which was potentially good, with indications (*) of days of data subsequently rejected.

Data on engine make, model, and serial number were collected during the installation, but subsequent review of these data proved unreliable. The field installation team had difficulty in locating these data from trucks due to their condition and general lack of sufficient available data. These data were supplied separately to EPA along with owners name, truck license number and other data. EPA independently gathered additional information from manufacturers, owners, registration data and other sources to create a more complete identification of engine records. These data are included in Table 9.

Survey Truck Distribution to Sample Plan

Table 8 compares the survey trucks by truck number and number of truck days within the final data file with the sample plan. This table indicates that the survey actually conducted is in agreement, in general, with the plan.

A total of 29 single unit, 2-axle, gasoline powered trucks have acceptable data for a total of 105 truck days. Three extra trucks were surveyed in Brooklyn and 7 extra truck days are available in the data than were required by the plan. Some data, previously rejected due to inadequate horsepower model development

TABLE 8

SURVEY DISTRIBUTION

New York City

Truck Type	2D		3A		TT	
Fuel Type	G	D	G	D	G	D
Bronx	(1) 25/3 (2) 38/4 (3) 48/4*	(1) 47/3		(1) 57/2		(1) 27/2 (2) 55/3
Subtotal	/11	/3		/2		/5
Brooklyn (kings Co.)	(1) 02/2 (2) 06/2 (3) 11/3 (4) 26/5* (5) 31/5 (6) 33/1 (7) 45/5 (8) 49/5 (9) 50/6 (10) 32/3 (11) 61/2	(1) 62/5	(1) -	(1) 36/5 (2) 37/2	(1) 30/3 (2) 64/5	(1) 60/3 (2) 43/4
Subtotal	/39	/5		/11	/8	/3
Manhattan (New York Co.)	(1) 04/5** (2) 05/3** (3) 12/3 (4) 13/5* (5) 16/4 (6) 20/4 (7) 29/3 (8) 44/5 (9) 51/4 (10) 52/4	(1) 58/5 (2) -		(1) 54/4	(1) 39/4	(1) 34/5 (2) 10/3
Subtotal	/38	/5		/4	/4	/8
Queens	(1) 03/2 (2) 08/3 (3) 09/5 (4) 17/3 (5) 35/4*		(1) 28/4 (2) 59/2	(1) -	(1) 07/2	(1) 42/3* (2) 56/4
Subtotal	/17				/2	/7
Richmond						(1) 65/2 (2) 53/5
Subtotal						/7
TOTAL	(29) /105 (52) /185	(3) /3	(2) /6	(4) /13	(4) /14	(10) /34

		TRUCK NUMBER	
Legend	(x)	xx	/x
	Sample Number		Number Good Truck Days

* Indicates Good Raw Data Tape; Horsepower Model not Acceptable.

** Cassettes for an additional day exist, but original transcribed tape was not readable; could not reprocess due to return of equipment to Government.

for a given truck, is otherwise acceptable by data control procedures applied to raw data. Distributions of trucks within this truck category by borough is otherwise in agreement with the sample plan in both truck numbers and truck days.

The 2-axle, single unit, diesel truck category is represented by data on 3 trucks for 13 days as compared to 4 trucks for 14 days in the sample plan. Two trucks based in Manhattan were required to be monitored for 6 days total in the sample plan. Due to the small numbers of this type truck in Manhattan, truck acquisition produced a problem. The single truck was surveyed for 5 days to generate representative data for Manhattan trucks in this category.

In the 3-axle, single unit, gasoline truck category, 2 trucks were surveyed for 6 days. This total was in agreement with the totals required by the sample plan, however, both trucks were based in Queens rather than one each in Queens and Brooklyn. This again was due to truck acquisition problems but the operational characteristics of trucks in Brooklyn are thought to be comparable to those in Queens and this sample is therefore representative.

The gasoline tractors in the survey total 4 vehicles for 14 days and are distributed by borough in agreement with the sample plan. Diesel tractors in the survey total 10 vehicles for 34 days as compared to the sample plan of 10 vehicles is distributed by borough in accord with the plan, the number of acceptable days are in slight but not significant disagreement. The two Bronx tractors produced 5 good days of data instead of the planned 6 days. One extra was generated by the Brooklyn, Queens, and Richmond tractors, and two extra days by the Manhattan vehicles.

The survey data file contains data on a total of 52 trucks and 185 truck days of data compared with the sample plan requirements of 50 trucks for 172 days.

These differences should be considered in future data processing activities related to the survey data file.

Survey Data Control

Acceptability of data was primarily based upon the criterion of percentage of zero scans to total scans in the daily tapes, as described in Chapter 6. The results of these control analyses is summarized in Table 9. Here, the total scans, number of zero scans, the percent zeros, and the accept/reject actions taken are cross referenced with truck number and truck day. Two tapes were rejected because of instrumentation difficulties not previously detected and not of the nature to produce zero scans.

Calibration Models

The conversion of selected data to engineering terms required the generation of mathematical relationships between sensor output voltage and conventional dimensions. These models were engine rpm, vehicle speed and engine temperature. These models were applied to raw sensor outputs in channels 3, 5, and 9 of the raw data tapes to generate the calibrated tapes. Raw data were recorded in millivolts; coefficients in models relate to 0-1 volt range. A summary of the coefficients resulting from the application of field calibrations and data processing described previously in the report is given in Table 10. Load factor

Table 9

SURVEY DATA CONTROL SUMMAR

DAY	1				2				3		
Truck No.	Total No. Scans	Number of Zero Scans	% Zeros	Accept/ Reject	Total No. Scans	Number Zero Scans	% Zeros	Accept/ Reject	Total No. Scans	Number Zero Scans	% Zeros
1	N.I.				23071	550	2.38	A			
2	27867	66	.24	A	33977	108	.32	A	21559	10	.05
3	22075	122	.55	A	73433	2798	3.81	A	36471	449	1.23
4	25805	8	.03	A	28584	1548	5.42	A	28980	4865	17.20
5					37595	558	1.48	A			
6	25808	9	.03	A	37396	172	.46	A			
7	34595	191	.55	A	43385	272	.63	A	22220	234	1.0
8	19478	270	1.39	A	33565	156	.46	A	33355	198	.59
9	22153	665	3.00	A	39439	2	.01	A	46391	42	.09
10	43239	12	.03	A	21440	22	.10	A	26944	182	.68
11	24759	12	.05	A	7310	84	1.15	A	24191	328	1.3
12	43919	259	.59	A	28189	36	.13	A	22473	725	3.2
13	29295	293	1.00	A							
14	N.I.										
15	D.R.				30047	146	.49	A	29466	48	.1
16	76854	3326	4.33	A	27453	4501	16.30	R	25885	4016	15.5
17	30277	719	2.37	A							
18	N.I.										
19	N.I.				45779	1356	2.96	A	44819	13	.0
20	21599	8	.04	A							
21	N.I.										
22	N.I.										
23	N.I.										
24	N.I.				42356	43	.10	A	38501	22	.
25	34018	20	.06	A	42555	55	.13	A	32101	23	.
26	30639	16	.05	A							
27	29130	7	.02	A	29867	1516	5.08	A	32520	18	.
28	30479	27	.09	A					15779	474	3.
29	36199	116	.32	A	29323	4	.01	A	30433	90	.
30	15953	3	.02	A	29819	31	.10	A	29789	39	.
31	29207	22	.08	A							
32	29999	408	1.36	A	32038	28	.09	A			
33					31558	85	.27	A	13258	198	1.
34	14757	36	.24	A	27059	76	.28	A	28499	26	.
35	30694	16	.05	A	46200	20	.04	A	46739	22	.
36	40199	25	.06	A	39179	62	.16	A			
37	44375	193	.43	A	45119	101	.22	A			
38	38399	634	1.65	A	30299	223	.74	A			
39	8759	123	1.40	A							
40	N.I.										
41	N.I.								30899	102	
42	29159	183	.63	A	5435	3	.06	A	28799	405	1.
43	38939	455	1.17	A	30539	117	.38	A	34979	310	
44	26639	157	.59	A	27299	77	.28	A	30837	181	
45	25859	52	.20	A							
46	N.C.				54958	362	.66		50579	173	
47	46199	939	2.03		32999	70	.21	A			
48	32579	14	.04	A	20699	6	.03	A	35723	82	
49	12479	108	.87	A	28379	179	.63	A	29279	143	
50	30720	48	.16	A	27356	18	.07	A	25372	17	
51	30479	11	.04	A	34380	131	.38	A	19472	81	
52	34665	74	.21	A	12839	74	.58	A	8039	13	
53	16029	10	.06	A	38323	142	.37	A	26400	14	
54	39950	213	.53	A	32759	436	1.33	A	31679	41	
55											
56	29197	28	.10	A	56279	738	1.31	A			
57	35519	13	.04	A	47999	40	.08	A	46556	170	
58	40435	45	.11	A	26278	2	.01	A			
59	23339	13	.06	A	36218	18	.05	A	44577	46	
60	38219	25	.07	A					32285	39	
61	41554	184	.44	A	27118	31	.11	A	32460	26	
62	24839	11	.04	A							
63					33167	411	1.24	A	36780	73	
64	29159	119	.41	A	14758	29	.20	A			
65	33599	874	2.60	A							
70**	13678	9	.07	A							
80	10096	7026	75.80	R	45034	10836	24.10	R	49893	91	
81	34726	18	.05	A	64885	267	.41	A	51839	495	
82	34980	108	.31	A	49900	3019	6.05	A	52884	36	
83					52859	198	.37	A	31440	5	
84									35373	433	

** 6th day for truck 50. Assigned number 70 for control purposes.

NOTE: N.I. is not Installed
D.R. is Data Rejected
N.C. is Instrumentation not calibrated.

Table 9

DATA CONTROL SUMMARY

3				4				5			
otal No. Scans	Number Zero Scans	% Zeros	Accept/ Reject	Total No. Scans	Number Zero Scans	% Zero	Accept/ Reject	Total No. Scans	Number Zero Scans	% Zero	Accept/ Reject
559	10	.05	*								
471	449	1.23	A					17804	1126	6.32	A
980	4865	17.20	R	27417	2332	8.51	A				
220	234	1.05	A								
3355	198	.59	A	32632	692	2.12	A	32051	284	.89	A
6391	42	.09	A								
6944	182	.68	A								
191	328	1.36	A								
473	725	3.23	A	29145							
					72	.25	A	22517	983	4.37	A
66	48	.16	A	38619							
885	4016	15.50	R	31443							
					26	.07	A				
					3052	9.71	A	38092	1357	3.57	A
19	13	.03	A	45959							
					2163	4.71	A				
501	22	.06	A								
101	23	.07	A	38455	28	.07	A	41980	32	.08	A
				29105	342	1.18	*	33760	282	.84	A
520	18	.06	A	30421	301	.99	A				
779	474	3.00	A					36519	197	.54	A
433	90	.30	A								
789	39	.13	A	19[illegible]20	1	.01	A	29416	176	.60	A
				4[illegible]39	53	.12	A	33899	56	.17	A
258	198	1.49	A	33719	238	.71	A	35338	446	1.26	A
499	26	.09	A	30119	155	.51	A				
739	22	.05	A	17219	13	.08	A	15959	19	.12	A
				39059	30	.08	A	44039	13	.03	
				31139	714	2.29	A	25078	711	2.84	A
899	102	.33	A	37979	195	.51	A				
799	405	1.41	A	13919	5	.04	A				
979	310	.89	A	30839	12	.04	A	39839	336	.84	A
37	181	.59	A	28139	79	.28	A	8637	301	3.49	A
79	173	.34									
				30020	47	.16	A	33839	9	.03	A
23	82	.23	A	15779	91	.58	A	17339	6	.03	A
79	143	.49	A	28918	74	.26	A	31739	656	2.07	A
72	17	.07	A	24839	73	.29	A				
72	81	.42	A	23819	23	.10	A				
39	13	.16	A	10499	30	.29	A	8099	18	.22	A
00	14	.05	A	29700	2	.01	A				
79	41	.09	A	37857	399	1.23	A				
					64	.17	A	29799	83	.28	A
86	170	.37	A	37609	49	.13	A	41456	755	1.82	A
577	46	.10	A								
85	39	.12	A								
60	26	.08	A	22980	13	.06	A	27660	4	.01	A
80	73	.20	A	37680	731	1.94	A	33060	675	2.04	A
93	91	.18	A	42040	358	.85	A	50503	972	1.92	A
39	495	.95	A	67888	2824	4.16	A	35717	483	1.35	A
84	36	.07	A								
40	5	.02	A	18280	0	.00	A	19800	2	.01	A
73	433	.12									

Table 10
CALIBRATION MODEL SUMMARY

Truck No.	Engine RPM Model A(x) + B		Vehicle Speed Model A(x) + 0 X= Channel 5 Voltage	Engine Temp. Model A(x) + B x = Channel 8 Voltage		Date Field Calibrated
	A	B		A	B	
1	-	-	-	-	-	-
2	10022.75	-12.37	99.80	-543.413	237.590	8/21/73
3	9991.38	0.49	100.00	-272.931	231.931	8/23
4	9976.77	15.79	98.62	-543.413	237.590	8/24
5	10048.13	-7.00	99.21	-593.909	236.350	8/24
6	9999.98	0.01	100.00	-393.548	227.742	8/27
7	9999.98	0.01	98.42	-275.294	232.372	8/30
8	10002.79	0.97	100.40	-311.213	224.137	9/07
9	10005.59	-1.40	100.20	-364.641	229.503	9/13
10	10030.03	-2.00	98.43	-549.356	238.369	9/13
11	9948.17	3.01	99.40	-296.703	227.725	9/19
12	9809.23	11.73	98.81	-331.707	226.927	9/26
13	10002.79	0.97	100.20	-308.046	224.630	9/28
14	—	—	—	—	—	—
15	—	—	—	-347.319	226.587	10/12
16	9979.91	-3.29	99.60	-292.632	223.413	10/18
17	9999.98	0.01	99.21	-257.885	221.800	10/25
18	—	—	—	—	—	—
19	—	—	—	—	—	—
20	9959.99	3.37	98.81	-362.500	225.050	11/12
21	—	—	—	—	—	—
22	—	—	—	—	—	—
23	—	—	—	—	—	—
24	—	—	—	—	—	—
25	9988.50	6.21	98.80	-242.532	222.186	5/20/74
26	2071.24	8.44	102.04	-248.677	222.196	5/02
27	7499.55	0.23	100.00	-228.663	221.604	5/30
28	10014.26	-5.23	72.67	-305.361	224.214	9/18
29	9997.08	2.40	100.00	-311.946	225.413	5/28
30	9985.69	1.91	100.00	-250.438	222.268	5/29
31	9999.98	0.01	100.40	-304.051	227.203	6/03
32	22289.51	-3.45	100.25	-267.605	223.507	8/17
33	9982.79	4.31	100.40	-291.028	223.932	6/05
34	6967.03	-8.78	100.00	-221.612	225.518	7/03
35	9965.63	5.24	100.81	-360.704	226.068	6/10
36	9976.95	-0.44	100.00	-243.513	226.611	7/31
37	13333.31	0.00	99.75	-274.390	223.799	6/13
38	9999.98	0.01	100.00	-294.521	223.486	6/18
39	9999.90	3.36	100.56	-309.090	224.363	6/17
40	—	—	—	—	—	—
41	—	—	—	—	—	—
42	15032.83	-22.36	103.73	-325.699	225.027	6/24
43	14162.13	-2.68	102.25	-152.454	226.636	8/05
44	20000.00	0.00	100.00	-336.002	225.440	7/17
45	9999.98	0.00	99.49	-238.178	221.289	6/25
46	—	—	—	—	—	—
47	4047.39	-0.50	100.00	-181.159	225.587	8/14
48	10000.01	-0.01	99.80	-235.690	221.427	6/28
49	10017.12	--.62	100.00	-331.476	225.922	7/15
50	10022.88	-9.06	99.80	-255.597	223.502	7/25
51	9999.98	0.01	100.00	-406.154	242.462	7/26
52	10011.32	-2.83	100.40	-187.209	226.212	9/10
53	7987.16	2.67	100.00	-396.875	250.100	8/16
54	3310.73	8.09	100.00	-300.448	223.717	9/13
55	2499.04	1.18	103.52	-335.092	226.074	8/08
56	3458.61	4.69	99.01	-357.143	226.286	8/16
57	3200.43	1.21	99.80	—	—	8/19
58	3453.94	4.96	99.80	-333.333	224.999	9/12
59	10002.67	-9.00	100.00	-389.381	227.964	8/21
60	10075.50	-12.10	100.00	-173.442	224.835	8/23
61	6313.18	-15.48	100.00	-220.751	223.100	9/04
62	3547.67	0.67	100.00	-338.753	227.921	8/27
63	—	—	—	—	—	—
64	10022.86	-19.08	99.80	-224.779	238.266	8/29
65	3353.11	-22.18	100.00	-335.979	225.775	8/29
70	10222.88	-9.06	99.80	-255.597	223.502	7/25
Buses						
80	16666.69	0.00	100.00	-307.692	224.306	10/3/73
81	9852.11	-1.63	100.00	-262.264	222.491	10/12/73
82	10162.45	-4.05	100.00	-262.264	222.491	11/02/73
83	—	—	100.00	-212.575	220.503	11/08/73

and horsepower models were also generated but not applied. They are summarized in Appendix E.

Data File Format

The survey data is available in 2 sets of 14 tape reels. One set contains edited raw data in which the survey parameters are in the sensor output voltage form. This set is termed the Raw Data Tape File. The other set contains survey data in engineering terms with the exception of load factor which remains in raw data form. This set is termed the Calibrated Data Tape File.

Raw Data Tape Format - A number of truck days are recorded on each tape. Each truck day of data is preceded by a header of the format shown in Table 11. The header shows truck identification, rpm calibration points, ambient temperature calibration points, and coefficients, vehicle speed calibration points, and coefficients, gear ratio calibration. The total scan count, total zero count and percent zeros resulting from the validation test are also included in the header. Manifold vacuum model coefficients, horsepower model coefficients and horsepower calibration data are also included in the header. Following this information, data for individual scans are written. The scan interval in real time is 0.83 seconds. Scans which were zeroed due to parity failure in reading cassette data are carried as all zeroes. This identifies that the 0.83 second interval did occur in real time, but data for that interval is invalid and should be considered in subsequent data processing. Each scan contains 40 bytes of data corresponding to the 10 channels originally recorded as shown in Table 11.

Raw data tapes are written in BCD, 9-track, EBC DIC format at a density of 800 bytes per inch.

Table 11

RAW DATA TAPE HEADER FORMAT

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E.P.A. TRUCK STUDY 120210

PAGE 1 OF 2

TRUCK PARAMETER POSITIONS 1 THRU 80	TRUCK ID	CITY	TYPE TRUCK	FUEL TYPE	GROSS WEIGHT	LICENSE NUMBER	IND. CLASS	ENGINE MODEL	ENGINE SERIAL NUMBER	• ORIS	DAY				
RPM CALIBRATION ONE CARD POSITIONS 1 THRU 80	TRUCK ID	DAY	RPM 1	CALIB READING	RPM 2	CALIB READING	RPM 3	CALIB READING	RPM 4	CALIB READING	RPM 5	CALIB READING	RPM 6	CALIB READING	3
AMBIENT TEMPERATURE CALIBRATION ONE CARD POSITIONS 1 THRU 80	TRUCK ID	DAY	TEMPERATURE AMBIENT	BOILING WATER	COEFFICIENT A XXXX.XXX	COEFFICIENT B XXXX.XXX	4								
VEHICLE SPEED CALIBRATION ONE CARD POSITIONS 1 THRU 80	TRUCK ID	DAY	MPH	CALIB	ADJUST FACTOR XXX.XXXX	5									
GEAR RATIO PARAMETERS VARIABLE NUMBER CARDS POSITIONS 1 THRU 80	TRUCK ID	DAY	GEAR	R/V RATIO XXXX.XXX	ENGINE RPM	WHEEL RPM XXX.X	VEHICLE SPEED	E SPD / W SPD RATIO XXXX.XXX	GR						
ERROR SUMMARY ONE CARD POSITIONS 1 THRU 80	TRUCK ID	DAY	TOTAL SCAN COUNT	TOTAL ZERO SCANS	PERCENT ZERO XX.XX	ES									

Table 11 (Cont'd.)

E P A TRUCK STUDY 1:0210

RAW DATA TAPE HEADER FORMAT

PAGE 2 OF 2

MANIFOLD VACUUM MODEL ONE CARD POSITIONS 1 THRU 80	TRUCK ID DAY MANIFOLD VACUUM MODEL COEFFICIENTS MM
HORSEPOWER VARIABLES VARIABLE NUMBER CARDS POSITIONS 1 THRU 80	TRUCK ID DAY RPM MANIFOLD VACUUM XX.XXX HORSE POWER CHAN 3 CHAN 4 M4
END OF CALIBRATION DATA ONE CARD POSITIONS 1 THRU 80	ALL OTHER POSITIONS BLANK
CALIBRATED DATA RECORDS VARIABLE NUMBER POSITIONS 1 THRU 40	TRUCK ID TIME HHMM NOT USED RPM HORSE POWER VEH SPEED ROAD TYPE TRAF CONDI TIONS VALVE CLOSED ENGINE TEMP R/V RATIO * POS 9-40 FLOATING POINT

Calibrated Tape Format - Similar header information precedes each truck day entry on the calibrated tapes as shown in Table 12. The data field follows consisting of 40 bytes per scan. The first 2 bytes indicate truck number, followed by bytes indicating the time in hours and minutes. The next 2 bytes are not assigned. The remaining 32 bytes consist of 4-bytes data for the eight channels indicating RPM, load factor, vehicle speed, road type, traffic conditions, throttle valve position (open/closed), engine temperature, and V/S ratio. This last entry was generated by the process program by dividing vehicle speed by engine rpm to assist in the determination of the gear being used in that data scan. Calibrated tapes are written in 9-track, floating point, EBC DIC format at a density of 800 bytes per inch.

Data File Cross-Reference

Each data tape and cassette was assigned a number. A cross reference between truck and truck day for the cassette, raw and calibrated data tapes is shown in Table 13. Another cross-reference, Table 14, indicates the contents of raw calibrated tapes by tape number.

Another set of 6 tapes are included in the data file for record. These tapes contain calibrated data for trucks, and employed the corresponding horsepower models to transcribe raw load factor data to horsepower. These are considered test tapes and are not part of the official survey data file. A cross reference of these tapes to indicate truck number and day number is given in Table 15.

Utility Dump Program

The purpose of this program is to list a raw or calibrated tape. The program is written in COBOL and Assembler. A card is read via the "ACCEPT" verb to provide control parameters.

Table 12

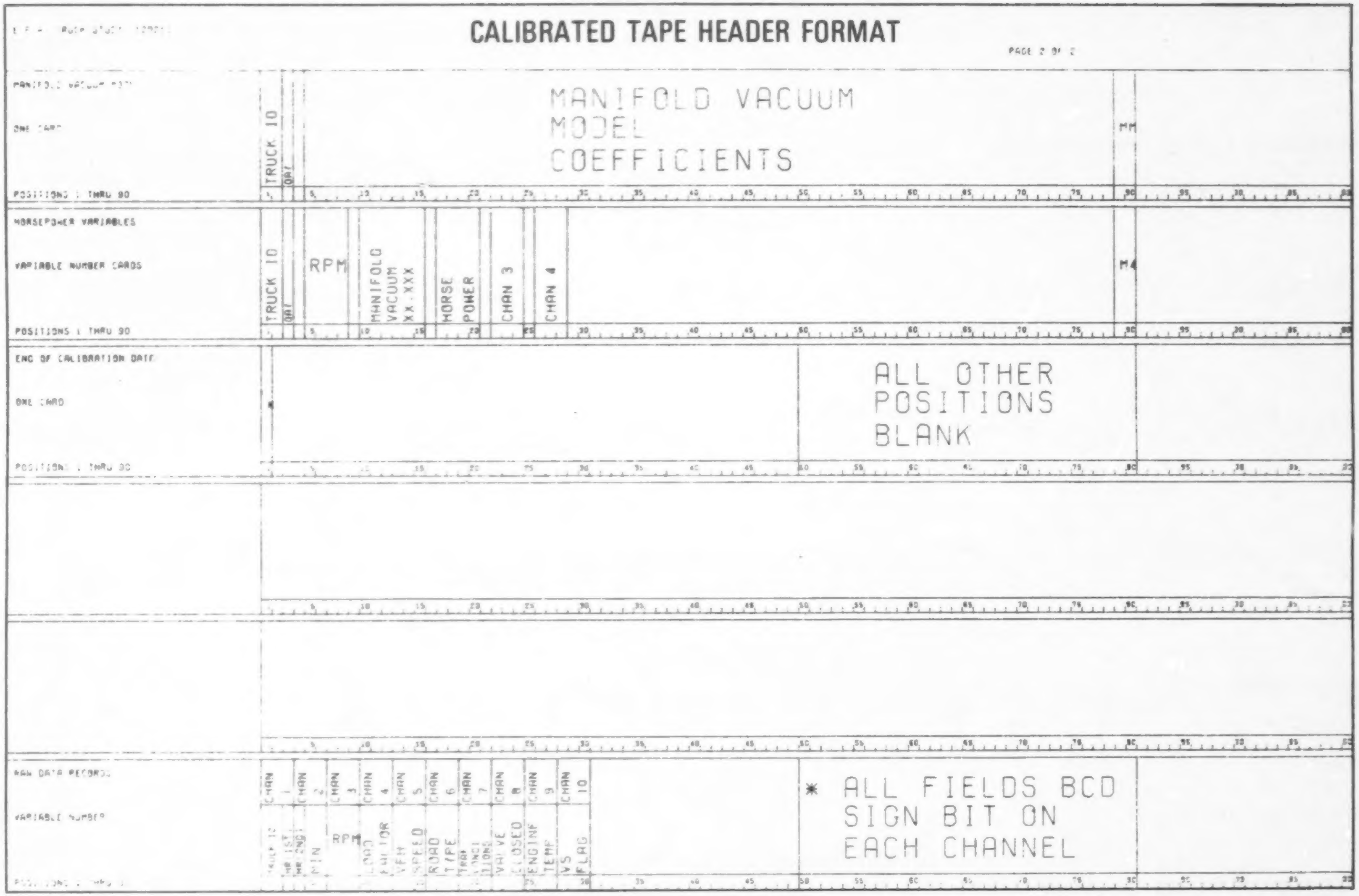
E P A TRUCK STUDY [illegible]

CALIBRATED TAPE HEADER FORMAT

PAGE 1 OF 2

TRUCK PARAMETER POSITIONS 1 THRU 80	TRUCK ID	CITY	TYPE TRUCK	FUEL TYPE	GROSS WEIGHT	LICENSE NUMBER	IND. CLASS	ENGINE MODEL	ENGINE SERIAL NUMBER	• DR/S	DAT				
RPM CALIBRATION ONE CARD POSITIONS 1 THRU 80	TRUCK ID	DAT	RPM 1	CALIB READING	RPM 2	CALIB READING	RPM 3	CALIB READING	RPM 4	CALIB READING	RPM 5	CALIB READING	RPM 6	CALIB READING	3
AMBIENT TEMPERATURE CALIBRATION ONE CARD POSITIONS 1 THRU 80	TRUCK ID	DAT	TEMPERATURE AMBIENT	BOILING WATER	COEFFICIENT A XXXX.XXX	COEFFICIENT B XXXX.XXX									4
VEHICLE SPEED CALIBRATION ONE CARD POSITIONS 1 THRU 80	TRUCK ID	DAT	MPH	CALIB	ADJUST FACTOR XXX.XXXX										5
GEAR RATIO PARAMETERS VARIABLE NUMBER CARDS POSITIONS 1 THRU 80	TRUCK ID	DAT	GEAR	R/V RATIO XXXX.XXX	ENGINE RPM	WHEEL RPM XXX.X	VEHICLE SPEED	E SPD / W SPD RATIO XXXX.XXX							GR
ERROR SUMMARY ONE CARD POSITIONS 1 THRU 80	TRUCK ID	DAT	TOTAL SCAN COUNT	TOTAL ZERO SCANS	PERCENT ZERO XX.XX										ES

Table 12 (Cont'd.)



CALIBRATED TAPE HEADER FORMAT

E.P.A. TRUCK STUDY [illegible]

PAGE 2 OF 2

MANIFOLD VACUUM MOD ONE CARD POSITIONS 1 THRU 90	TRUCK ID DAY MANIFOLD VACUUM MODEL COEFFICIENTS MM	
HORSEPOWER VARIABLES VARIABLE NUMBER CARDS POSITIONS 1 THRU 90	TRUCK ID DAY RPM MANIFOLD VACUUM XX.XXX HORSE POWER CHAN 3 CHAN 4 M4	
END OF CALIBRATION DATE ONE CARD POSITIONS 1 THRU 90	*	ALL OTHER POSITIONS BLANK
RAW DATA RECORDS VARIABLE NUMBER POSITIONS 1 THRU 90	CHAN 1: TRUCK ID, HR 1ST, HR 2ND CHAN 2: MIN CHAN 3: RPM CHAN 4: LOAD FACTOR CHAN 5: VEH SPEED CHAN 6: ROAD TYPE CHAN 7: TRANSITIONS CHAN 8: VALVE CLOSED CHAN 9: ENGINE TEMP CHAN 10: VS FLAG	* ALL FIELDS BCD SIGN BIT ON EACH CHANNEL

Table 13

DATA TAPE FILE CROSS REFERENCE BY TRUCK NUMBER AND TRUCK DAY

	1			2			3			4			5		
Truck No.	Cassette	Raw	Calibrated	Cassette	Raw	Calibrated	Cassette	Raw	Calibrated	Cassette	Raw	Calibrated	Cassette	Raw	Calibrated
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	350	538	512	351	538	512	—	—	—	—	—	—	—	—	—
3	352	538	512	353	538	512	—	—	—	—	—	—	—	—	—
4	355	548	518	356	548	518	357	548	518	—	—	—	359	548	518
5	360	—	—	361	540	514	362	Tape	Rejected	363	540	514	—	—	—
6	364	540	514	365	540	514	—	—	—	—	—	—	—	—	—
7	366	542	516	367	542	516	—	—	—	—	—	—	—	—	—
8	368	550	520	369	552	522	370	550	520	—	—	—	—	—	—
9	371	558	534	372	542	516	373	542	516	374	528	516	375	528	516
10	376	552	522	377	552	522	378	552	522	—	—	—	—	—	—
11	379	552	522	380	552	522	381	552	522	—	—	—	—	—	—
12	382	552	522	383	552	522	384	552	522	—	—	—	—	—	—
13	385	558	534	385	558	534	386	558	534	387	558	534	388	558	534
14	389	Tape	Rejected	390	Tape	Rejected	—	—	—	—	—	—	—	—	—
15	391	Tape	Rejected	392	Tape	Rejected	393	Tape	Rejected	394	Tape	Rejected	395	Tape	Rejected
16	396	552	522	397	552	522	398	552	522	399	552	522	326	Tape	Rejected
17	327	538	512	328	Tape	Rejected	329	Tape	Rejected	330	538	512	450	538	51[illegible]
18	331	Tape	Rejected	332	Tape	Rejected	333	Tape	Rejected	334	Tape	Rejected	335	Tape	Rejected
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	451	558	534	452	564	546	453	560	536	454	558	534	—	—	—
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	1	556	526	4	556	526	24	556	526	—	—	—	—	—	—
26	28*	570	566	32*	570	566	6	570	566	17	570	566	13	570	566
27	85*	538	512	—	—	—	—	—	—	50	Tape	Rejected	88	538	512
28	220	558	534	415	558	534	401	570	566	420	558	534	—	—	—
29	47*	542	516	—	—	—	36	570	566	—	—	—	46	542	516
30	11	548	518	49	548	518	27	548	518	—	—	—	—	—	—
31	34	560	536	48	560	536	37	560	536	45	560	536	30	560	536
32	218	542	516	—	—	—	—	—	—	160	540	514	130	540	514
33	41	Tape	Rejected	41	548	518	—	—	—	—	—	—	—	—	—
34	92	550	520	52	550	520	144	550	520	148	550	520	110	558	534
35	86	540	514	100	540	514	81	540	514	79	540	514	—	—	—
36	204	550	520	208	550	520	214	55[illegible]	520	217	556	526	161	550	520
37	84	548	518	16	548	518	—	—	—	—	—	—	—	—	—
38	94	542	516	77	542	516	—	—	—	68	558	534	93	552	522
39	83	542	516	87	542	516	—	—	—	78	542	516	70	542	516
40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
42	76	538	512	—	—	—	73	538	512	65	538	512	—	—	—
43	150,145	550	520	126	550	520	107	550	520	101	558	534	—	—	—
44	114	548	518	124	548	518	134*	548	518	135*	548	518	136*	548	518
45	60	540	514	91*	540	514*	71	540	514	59	540	514	61	540	514
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
47	209	556	526	163	556	526	172	556	526	—	—	—	—	—	—
48	139*	538	512	55*	538	512	—	—	—	74	538	512	143	538	512
49	147	562	544	108*	562	544	115	562	544	57	562	544	120	562	544
50	149	562	544	300*	562	544	221	562	544	206	562	544	215,202	562	544
51	102	550	520	208	562	544	207	562	544	216	550	520	—	—	—
52	418	560	536	406	570	566	405	570	566	414	570	566	—	—	—
53	210	556	526	192	556	526	201	556	526	201	556	526	162	556	526
54	411	564	546	205	564	546	180	564	546	210	564	546	—	—	—
55	—	—	—	193	560	536	217	560	536	999	560	536	—	—	—
56	104	570	566	—	—	—	157*	564	546	175	564	546	186	564	546
57	213	558	534	155,190	558	534	—	—	—	—	—	—	—	—	—
58	219*	564	546	179	564	546	403*	564	546	207	564	546	203	564	546
59	151	560	536	171	560	536	—	—	—	—	—	—	—	—	—
60	170	556	526	154	556	526	158	556	526	—	—	—	—	—	—
61	187	572	568	—	—	—	409	560	536	—	—	—	—	—	—
62	301	560	536	176	560	536	422	572	568	169	572	568	417	572	568
63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
64	185	562	544	178	562	544	188*	562	544	416	572	568	408	562	544
65	400	560	536	421	560	536	—	—	—	—	—	—	—	—	—
70	149**	570	566	—	—	—	—	—	—	—	—	—	—	—	—
Bus															
80	—	—	—	—	—	—	501	554	524	502	554	524	512	554	524
81	503	554	524	504	554	524	505	554	524	—	554	524	513	554	524
82	506	554	524	507	554	524	508	554	524	—	—	—	—	—	—
83	—	—	—	509	572	568	510	572	568	514	572	568	511	572	568
84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Indicates Truck day was reassigned by WSA for Processing(ie, Day 6 Field date replaces the first bad day of data 1-5, etc

** Reassigned from day 2 Truck 50 (Extra day)

Table 14
DATA TAPE FILE CROSS REFERENCE
BY TAPE NUMBER

TAPE NUMBER		TAPE CONTENTS (Truck No. - Day No.)															
CALIBRATED	RAW																
512	538	3-1	3-2	17-1	17-4	17-5	42-1	42-4	42-3	48-4	48-5	48-1	48-2	2-1	2-2	27-1	27-5
514	540	5-4	5-2	6-1	6-2	45-5	45-3	45-4	45-1	45-2	35-2	35-4	35-3	35-1	32-4	32-5	
516	542	38-2	38-1	39-2	39-4	39-5	39-1	9-2	9-3	9-4	9-5	29-1	29-5	7-1	7-2	32-1	
518	548	4-1	4-2	4-3	4-5	33-2	44-1	44-2	44-3	44-4	44-5	30-1	30-2	30-3	37-2	37-1	
520	550	34-2	34-1	34-3	34-4	36-1	36-5	36-2	36-3	43-1	43-2	43-3	51-1	51-4	8-1	8-3	
522	552	10-1	10-2	10-3	16-1	16-2	16-3	16-4	12-3	12-2	8-2	11-1	11-2	11-3	12-1	38-5	
524	554	80-3	80-4	80-5	81-1	81-4	81-5	81-2	81-3	82-1	82-3	82-2					
526	556	25-3	25-2	25-1	47-1	47-2	47-3	53-1	53-2	53-3	53-4	53-5	60-1	60-2	60-3	36-4	
534	558	8-1	13-1	13-2	13-3	13-4	13-5	38-4	20-1	20-4	34-5	43-4	57-1	57-2	28-1	28-4	28-2
536	560	61-3	62-1	62-2	52-1	55-4	55-3	55-2	59-1	59-2	65-1	65-2	20-3	31-1	31-5	31-2	31-3
544	562	49-1	49-3	49-4	49-5	49-2	51-3	51-2	50-1	50-4	50-3	50-5	50-2	64-1	64-2	64-3	64-5
546	564	56-4	56-5	56-3	54-1	54-2	54-3	54-4	58-2	58-5	58-1	58-3	58-4	20-2			
566	570	52-4	26-4	26-3	26-1	26-2	26-5	29-3	56-1	70-1	52-3	52-2	28-3				
568	572	83-3	83-4	83-2	83-5	61-1	62-3	62-4	62-5	64-4							

Table 15

TEST DATA - CALIBRATED TAPES (PRELIMINARY)

Tape No.	Tape Contents											
	(Truck No. - Day No.)											
528	2-1	2-2	9-2	9-3	9-4	9-5	4-1	4-2	4-3	4-4	4-5	
529	45-5	45-3	45-4	45-1	45-2	5-1	5-2	5-4	6-1	6-2	7-1	7-2
530	17-1	17-4	17-5	33-2	3-1	3-2	30-1	30-2	30-3	12-1		
531	31-1	31-5	31-2	31-3	31-4	38-2	38-1	39-2	39-4	39-5	39-1	
532	8-1	8-3	8-2	11-1	11-2	11-3	37-2	37-1	27-1	27-5		
533	34-2	34-1	34-3	34-4	34-5	44-1	44-2	44-3	44-4	44-5		

The control card has the following format:

Name	Positions From	Positions To
OPT	1	1
OPFLAG	2	2
OPCNT	3	9
OPBYP	11	17

To list a raw data tape, code '5' in OPT. OPFLAG is ignored. OPCNT is the record number of the last record to be printed. OPBYP is the number of records to bypass before printing begins. If OPBYP does not contain 7 numeric digits, OPBYP will be set to '0000000'. The calibration control records are always printed and are not included in OPCNT or OPBYP.

To list a calibrated data tape, code an '8' in OPT. Code '-' in OPFLAG. OPCNT and OPBYP serve the same purpose as for raw data tape.

A special list of a calibrated tape may be requested. If OPT is coded '9', OPBYP and OPCNT are ignored. OPFLAG is coded '-'. The program reads records searching for a record where the vehicle speed is greater than or equal to 1.0. It then lists the next 500 records.

The program was written to run in a DOS environment. To run in an OS environment, the call statements to 'INT', 'RHDR', and 'NOTPMK' can be removed. This will allow the user to eliminate the Assembler portion of the program. The Assembler routines are unique to DOS, so their removal will not affect the OS user.

Listing for this program is given in Appendix I.

APPENDIX A

SAMPLE PLAN DESIGN

The Phase II survey called for the instrumentation of 50 trucks in New York City and the accumulation of a total of 172 truck-days of data respectively. The number of days that any given truck to be monitored vary from 1 to 5 days.

Original Sample Plan

Twenty-four strata were originally identified based upon combinations of the following:

Industry Type

1. Wholesale
2. Manufacturing
3. Utilities/Communication/Transportation
4. Other

Vehicle Type

1. Two Axle/Single Unit
2. Three Axle/Single Unit
3. Tractor-trailer Combinations

Fuel Type

1. Gasoline
2. Diesel

The sampling plan must provide means for determining the number of total trucks to be instrumented. These were to be selected at random from the populations within each strata based upon the statistical relationships within the Phase I data.[*] Means must also be established to determine the number of days trucks in each strata are to be sampled. Subject to the restrictions of sample size and total truck-days of data to be assembled, the problem is to determine the distribution of number of trucks and days assigned to each strata which minimizes the variation between the estimate of vehicle use in VMT and the actual use profile.

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[*] "Heavy Duty Vehicle Driving Pattern and Use Survey-Final Report - Part I - New York City," by Wilbur Smith and Associates for EPA and CRC, dated May, 1973 (APTD-1523).

The original plan applied in the survey was mathematically derived, based upon a given set of inputs and consisting of the following for each stratification. It was assumed that a weight could be assigned to each strata determined from the fraction of total VMT attributed to trucks within that strata. It was also assumed that the variance in daily average VMT over five days for each truck in a given strata could be established or estimated from the Phase I survey data. Also the variance of daily VMT between trucks within the strata must be based upon the previous survey data.

With these assumptions, the equation expressing the fraction of trucks in strata h to be instrumented is:

$$\frac{\eta_h}{50} = \frac{\sqrt{\frac{W_h{}^2}{5\ N_h}\left\{\sum_{i=1}^{N_h}\frac{(5 - m_i^h)}{m_i^h}\ S_{i,h}{}^2\ 5N_h\ \ \partial_h{}^2\right\}}}{\sum_{h=1}^{L}\sqrt{\frac{W_h{}^2}{5\ N_h}\left\{\sum_{i=1}^{N_h}\frac{(5 - m_i^h)}{m_i^h}\ S_{i,h}{}^2 + 5\ N_h\ \partial_h{}^2\right\}}}$$

And the number of days to sample for truck i of strata h is given by:

$$M_i^h = 172\ \frac{\sqrt{\frac{W_h}{N_h\ \eta_h}\ S_{i,h}{}^2}}{\sum_{h=1}^{L}\sum_{i=1}^{N_h}\sqrt{\frac{W_h}{N_h\ \eta_h}\ S_{i,h}{}^2}}$$

Where:

W_h = weight assigned to strata h.

N_h = number of trucks in strata h.

$S_{i,h}^2$ = variance in daily average VMT over 5 days for truck i in strata h.

$\partial_h{}^2$ = variance in daily average VMT between all trucks in strata h.

L = number of strata = 24.

The meaning and use of the variables can be clarified by examining how the inputs were derived.

Total Trucks in the Strata

This input was compiled by reducing Table 12, page 34,[*] by eliminating the 6-10,000 pound GVW class and combining the total trucks for each category of user industry in the sample plan. This reduction yields the data in Table A-1.

Table A-1

Industry	Trucks
Manufacturing	208
U/C/T	322
Wholesale	236
Other	225
	991

The next step was to sub-stratify the number of trucks in each industry class by axle arrangement. This is done by using Table 11, page 32 and producing Table A-2.

Table A-2 includes trucks that weigh 6-10,000 pounds. Most of these are found in the 2-axle classification. For each industry, 2-axle class, the number of trucks was reduced by the appropriate ratio for each of these groups thus: manufacturing - 200/219, U/C/T - 322/327, Wholesale - 236/251, and Other - 225/250. Multiplying this ratio by the 2-axle trucks in each industry yields the number of trucks found in the sample, (i.e., manufacturing, 2-axle = 190 trucks, U/C/T, 2-axle = 258 trucks, etc.). The final sub-stratification was then done by fuel type. The percentages of each fuel type are found in Table C-10, page C-10.[*] Again this table is reduced by eliminating the 6,000-10,000 pound weight class, and yields Table A-3.

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[*] APTD-1523 (Ibid.)

Table A-2

Stratification of Number of Trucks by Truck Type and User Industry

Industry	Truck Type	Number of Trucks
Manufacturing	2	200
	3	7
	TT	12
Sub-total		219
U/C/T	2	263
	3	10
	TT	54
Sub-Total		327
Wholesale	2	235
	3	8
	TT	8
Sub-total		251
Other	2	221
	3	17
	TT	12
Sub-Total		250
TOTAL		1,047

Table A-3

Sample Plan Distribution of Trucks

Industry	Truck Type	Number of Trucks	Gas	Diesel
Manufacturing	2	190	174	16
	3	6	3	3
	TT	12	7	5
U/C/T	2	258	237	21
	3	10	5	5
	TT	54	37	17
Wholesale	2	221	202	19
	3	8	4	4
	TT	8	5	3
Other	2	196	174	22
	3	17	9	8
	TT	12	8	4
TOTAL		991		

VMT Weight for Each Strata - The VMT weight for each strata is derived in much the same manner as the number of trucks. The first step is to summarize the total number of miles for each industry. This is done by eliminating the 6,000-10,000 pound weight class found in Table 28, page 57.* The total VMT can then be summed by industry and truck type. This produces Table A-4.

Next, the Single Unit trucks need to be sub-divided into 2- and 3-axle strata. The tractor-trailer group is the same fraction found in the sample plan. The single unit trucks were sub-divided originally by the computer program that produced Table 28.* However, this sub-stratification can be estimated by using Table 31,* pages 61-62 and Table 22,* page 49. Table 31* outlines the number of trips per day for each industry and vehicle type.

For example, there are 2,732 trips per day for U/C/T 2-axle trucks and 72 per day for 3-axle trucks. From Table 22 the average number of miles per trip for 2-axle is 2.45 and for 3-axle 4.2. These numbers are then used to estimate the total miles traveled for U/C/T 2-axle trucks, 6,693.40, and U/C/T 3-axle trucks, 302.40 miles. As a fraction of the total miles, this represents .225 and .010 which approximates the actual fractions used in the sample of .231 for 2-axles and .011 for 3-axle.

The final sub-stratifications are by fuel and are performed in the same manner, using Table C-10, as was done for the number of trucks.

Variance in Daily Average VMT - This variance in VMT is stratified only by industry and truck type. The variance is considered the same for both gasoline and diesel trucks. This statistic was compiled by the computer program that generated the information found in Tables 31* and 22.* The values were

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*APTD-1523 (Ibid.)

Table A-4

Distribution of VMT By User Industry and Single Unit/Tractor Trailer

Industry	Axle	Total Miles	Fraction of Total
Manufacturing	SU	5,820.74	.196
	TT	1,394.91	.047
Sub-Total			.243
U/C/T	SU	7,196.93	.243
	TT	1,819.82	.061
Sub-Total			.304
Wholesale	SU	6,906.94	.232
	TT	277.58	.009
Sub-Total			.241
Other	SU	5,846.94	.197
	TT	450.16	.015
Sub-Total			.212
TOTAL		29,714.02	1.000

Table A-5

Statistical Relationships Used in Sampling Plan

Strata	g_h^2	∂_h^2	N_h	W_h
1. Wholesale, 2-Axle, Gasoline	2	422.1	174	0.175
2. Wholesale, 2-Axle, Diesel	2	422.1	16	0.016
3. Wholesale, 3-Axle, Gasoline	2	360.3	3	0.003
4. Wholesale, 3-Axle, Diesel	2	360.3	3	0.002
5. Wholesale, T-T, Gasoline	2	9446.9	7	0.026
6. Wholesale, T-T, Diesel	2	9446.9	5	0.021
7. UT/Comm./Trans., 2-Axle, Gasoline	4	739.9	237	0.212
8. UT/Comm./Trans., 2-Axle, Diesel	4	739.9	21	0.019
9. UT/Comm./Trans., 3-Axle, Gasoline	4	690.5	5	0.006
10. UT/Comm./Trans., 3-Axle, Diesel	4	690.5	5	0.005
11. UT/Comm./Trans., T-T, Gasoline	4	1936.0	37	0.042
12. UT/Comm./Trans., T-T, Diesel	4	1936.0	17	0.020
13. Manufacturing, 2-Axle, Gasoline	1	473.2	202	0.204
14. Manufacturing, 2-Axle, Diesel	1	473.2	19	0.019
15. Manufacturing, 3-Axle, Gasoline	1	458.5	4	0.005
16. Manufacturing, 3-Axle, Diesel	1	458.5	4	0.004
17. Manufacturing, T-T Gasoline	1	871.3	5	0.005
18. Manufacturing, T-T, Diesel	1	871.3	3	0.004
19. Other, 2-Axle, Gasoline	5	515.1	174	0.155
20. Other, 2-Axle, Diesel	5	515.1	22	0.020
21. Other, 3-Axle, Gasoline	5	1201.7	9	0.012
22. Other, 3-Axle, Diesel	5	1201.7	8	0.010
23. Other, T-T, Gasoline	5	929.5	8	0.010
24. Other, T-T, Diesel	5	929.5	4	01005
TOTAL				1.000

Table A-5

Original Sample Plan

Industry Type	2-Axle Gas	2-Axle Diesel	3-Axle Gas	3-Axle Diesel	Tractor Gas	Tractor Diesel
Wholesale	(6)/3	(1)/3	-	-	(4)/3	(4)/3
Utility/Communication/ Transportation	(10)/4	(1)/4	-	-	(3)/3	(2)/3
Manufacturing	(8)/2	(1)/2	-	-	-	-
Other	(6)/5	(1)/5	(1)/5	(1)/5	(1)/5	-

Legend: (x)/x
No. Trucks No. Days

produced by sorting the vehicles by industry and axle class, and calculating the variance in miles traveled for each of these stratifications.

Estimated Variance in Average VMT Over 5 Days - This variance value is a measurement of the variability of miles traveled by all trucks in the strata for a period of 5 days. These figures are based on the overall Phase I analysis. For example, if an industry stratification has a variance value of 1, then all trucks in that strata will tend to drive the same number of miles per day for 5 days. If this value were 5, then there is a greater variability in miles driven each day for the same period. These values, are subjective in magnitude only, and could be verified by examining Tables 22,[*] 29,[*] and 31.[*] These values are determined by the industry type only.

The variance in daily VMT over 5 days $(S_{i,h})^2$ and variance in average VMT (∂_h^2) for each strata are shown in Table A-5, derived from the above procedures.

The original sample plan initially employed during field survey operations in 1973 is shown in Table A-6.

Revised Sample Plan

Prior to the restart of field survey operations in 1974, EPA proposed that the original New York City plan be modified by substituting a Geographical Category to replace the present User-Industry Category; to reduce the number of single-unit 2-axle dual rear tire gasoline trucks (2D) by 4; and to reassign these 4 trucks equally to the single-unit 3-axle dual rear tire trucks (gasoline and diesel). The proposed plan recognized that such an arrangement altered the VMT weighting and cited that appropriate weighting factors can be assigned to data before a specific cycle is generated. The initially proposed EPA plan totaled 182 truck-days. After some adjustments, the revised plan shown in Table A-6 was agreed upon. Field survey data taken in 1973 and in inventory was reviewed and trucks were assigned to the area in which they were based. This required recontacting all owners to establish actual base of operation rather than county of registration.

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[*] APTD-1523 (*Ibid.*)

The revised plan was implemented when field operations restarted May, 1974. When truck owners were contacted to fill this plan, an evident shift in the pattern of diesel versus gasoline trucks in some truck types were evident. As a result, another revised plan was proposed by the contractor and accepted by EPA. This plan is shown in Table 1.

Table A-6

Proposed EPA Sample Plan

Truck Type	2D		3A		Tractor		Total
Fuel Type	Gas	Diesel	Gas	Diesel	Gas	Diesel	
Area							
Bronx	(3)/11	(1)/3	-	-	-	(1)/2	(5)/16
Brooklyn	(8)/32	(1)/5	(1)/2	(1)/2	(3)/9	(1) 5	(15)/55
Manhattan	(10)/38	(2)/6	-	(1)/4	(3)/9	(2)/7	(18)/64
Queens	(5)/17	-	(1)/4	(1)/2	(1)/4	(1)/3	(9)/30
Richmond	-	-	(1)/2	-	(1)/4	(1)/1	(3)/7
TOTAL	(26)/98	(4)/14	(3)/8	(3)/8	(8)/26	(6)/18	(50)/172

Legend: (x)/x

No. Trucks No. Days

APPENDIX B

EVALUATION AND IMPROVEMENT PROGRAM DATA RECORDING AND RECOVERY

The readability, repeatability and reliability of the recorded data came under serious challenge when it was realized that some recorded data on the raw tape cassettes could not be read and translated to IBM machine compatible tape for further data processing. The manifestation of this difficulty was the number of data scans which were failing to meet parity when the cassettes were read and tape reels so developed were processed. An immediate and urgent investigation was initiated to review and analyze the entire process to disclose contributing factors. All aspects of the data collection/transcription process were studied including recording hardware, recording technique, transcription hardware and software. To understand the total implications of these efforts to date, it would serve a useful purpose to review the various technical aspects of the processes.

Recording/Transcription Process

Data is recorded on cassettes using a slightly modified Metrodata DL620B data logger. The recording density is 200 bits per inch at a tape speed of .25" per second. Each cassette contains 1200' of tape thereby allowing for up to 16 hours of continuous recording per cassette.

The cassettes themselves are of an endless loop type normally used for analog data in the audio range. For use in digital applications, the cassettes are presumably loaded by Metrodata with tape consistent with the requirements of digital data recording. Cassettes used during the testing are purchased from Metrodata rather than from the original cassette manufacturer.

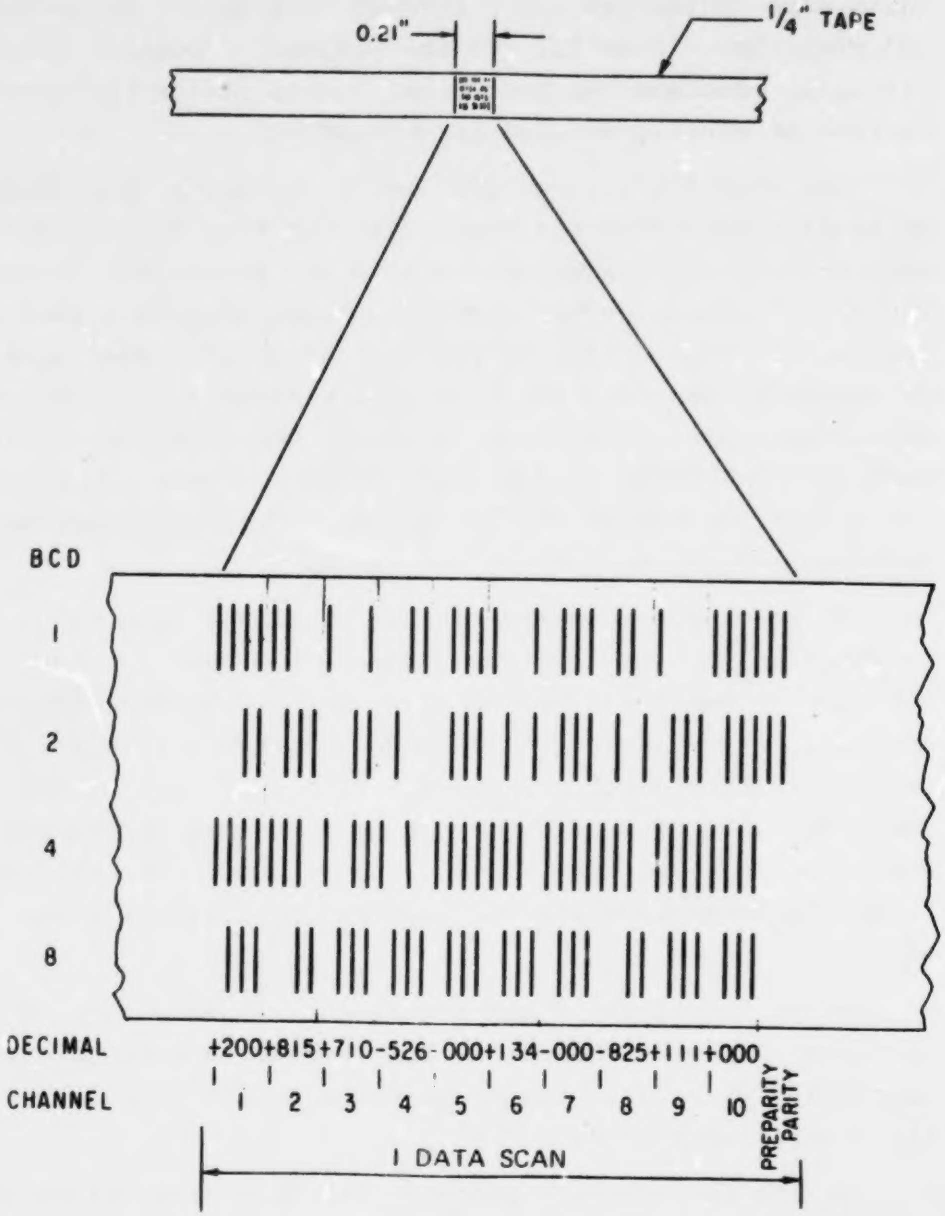
The Metrodata tape transport system is a single capstan, forward only device, utilizing a manually controlled, spring-loaded pinch roller assembly to provide the tape drive. Tape pressure against the record/read head is provided by a small block of foam rubber-type material mounted in the cassette itself. This system is used in both the data logger and tape reader.

Proper insertion of the cassette results in the tape being forced against the head by the foam material. Since the cassettes themselves provide no tape guiding action, tape guides are attached to the upstream and downstream sides of the record/read head.

Data recording is in a 4-bit parallel, BCD format. The data for any given sample in a channel consists of a sign bit followed by 3 BCD characters using a total of 4, 4-bit parallel tape characters. One complete data scan consists of ten data samples (40 characters) followed by preparity and parity characters for a total of 42, 4 bit parallel tape characters. This format is illustrated in Figure B-1

Upon completion of a given scan, the next scan begins immediately with the sign bit of the first data channel of the following scan with no special synchronization or spacing interspersed.

One important point to note is that in the record process, the data written on the cassette is the complement of the actual data. That is, the presence of a bit on tape indicates the absence of that bit in the data represented. For example, the presence of a bit on tape in all four tracks for a given character would be indicative of zero and the absence of a bit in all four tracks would be indicative of a character with a value equal to the sum of the four BCD weighted bits (1+2+4+8), which would in fact represent an illegal character and is used only as an example.


0.21"
1/4" TAPE
BCD
1
2
4
8
DECIMAL
+200+815+710-526-000+134-000-825+111+000
CHANNEL
1
2
3
4
5
6
7
8
9
10
PREPARITY
PARITY
1 DATA SCAN

IDEALIZED CASSETTE DATA FORMAT

Wilbur Smith and Associates

Figure B-1

Valid data characters are 0 through 9; sign (+) 10 or (-) 11; and preparity, 12 or 13. In the playback process, the characters are again complemented resulting in data presumably identical to that originally encoded for recording.

The playback process utilizes a Metrodata -625 reader. In reading data from the tape, all four bits of each character must be read simultaneously to form the proper BCD character. The read electronics for each tape track include a read amplifier, low pass filters, clipper, and peak detector. When a data bit is sensed by the read head, it is amplified X 200, filtered to eliminate noise, clipped to eliminate the negative portion of ware form and input to the peak detector where transformation to pulse form is accomplished. In the factory supplied unit, the gains of all amplifiers are fixed.

In reading a character (4-bit parallel) from tape, the output from the peak detector, that first detects a bit, triggers a window normally set to one half of the character-to-character spacing. At the end of this window, the data from all four tracks is strobed out. These data then, consist of the first bit detected, plus bits on other tracks occurring during the read window period. In this manner, skew of up to one half of the total character-to-character time can theoretically be tolerated.

Other functions of the reader include detection of proper sign and preparity characters for display, and synchronization generation of a "data ready" pulse to notify coupled hardware of the availability of data.

During the playback process, the Metrodata reader is coupled to a DMI 620 computer system. Data is read in four-bit parallel format each time a "data ready" pulse is received from the reader.

This data, beginning with the first sign character following the first preparity, is buffered scan-by-scan, for output to 1/2" magnetic tape. Validity checks performed include the following: (1) verification of the existence of 41 characters between preparity characters, (2) verification that only ten sign characters exist between preparity characters, (3) verification that each sign character is followed by three valid data characters. If any one or any combination of the above criteria are not met, the entire scan (10 channels) is written out to 1/2" tape as zeros. The beginning of the next scan is then identified as the first sign character following preparity, and the process is repeated.

This summarizes the process which was being employed at the time decrepancies in the data process were discovered. The description relates an ideal record/playback procedure.

Detection Against Gross Sensor Failure

The sensors in the instrumentation are of the nature that gross or catastrophic failure will be the predominant failure mode, that is, the output is present and valid or no output is received. A second, but less likely type failure, would be that resulting from a mechanical "hang-up" of a potentiometer wiper, producing an ouput which does not vary in a logical manner. These failure types are guarded against in at least four separate test sequences.

"On-line" Failure Check - As described elsewhere, the survey observer on the truck sequences at 1/2-hour intervals through a test procedure during the truck run. Using the built-in features incorporated in the data logger, he ripples the read-out selection switch through the channels, observing and recording the data indicated on a 3-digital "nixie" readout. He also checks for "reasonable" variation in data when compared to the truck operation at that moment. Failure to meet these tests is immediately reported. The installation is either repaired "on-the-spot" or the installation is repaired at the end of the day, and that day of data is repeated.

Monitoring at Time of Transcription - A procedure similar to the "on-line" test is repeated while the raw data cassette is being processed through the tape reader. This unit had similar built-in features as the data logger. Unlike the "on-line" test, this procedure now includes the recorded tape messages in its test.

Sample Data Dump - At the completion of the transcription to the 1/2-inch tape, this machine compatible tape reel is processed to print out, in hard copy, a sequential sample of 1 minute per hour of data. This sample is then visually checked for reasonable variations in data.

Data Processing Check - When the 1/2-inch tape is processed through the initial "Calibrate" program, a routine has been incorporated to monitor selected channels and search for value variation. If one of these channels remains fixed while the other guarded channels vary for a period of five minutes, the program calls for the tape to stop and an alert is given.

Hardware Contributing Factors

In investigating the high error rate tapes it became apparent that actual operation differed substantially from ideal operation in several ways and for a variety of reasons. Following is a discussion of the problems identified to date.

Tape Speed Instability - The tape transport mechanism in the data logger, instead of moving the tape smoothly across the recording heads, pulled the tape erratically. This jitter in tape speed caused the spacing between bits to vary as much as 25%. This type of discrepancy is illustrated in Figure B-2.

One major cause of this type operation can be attributed to the tape drive system. In this design, the single pinch roller system relies on the pressure of the foam rubber pad holding the tape against the head, and the tape cassette packing, to maintain constant tension on the tape. In practice this tension seems to vary resulting in the erratic tape motion. The problem was further aggravated by the Metrodata factory modification to 12 channels per second rather than 48 channels per second, which involved slowing the tape speed to 0.25 inches per second.

Skew - A vertical misalignment of the recording head causes the four parallel bits that comprise a character to be recorded in different longitudinal positions on a tape. The skew can cause the Track 4 bit to appear as much as 40% of the distance between the Track 1 bit of the same character and the next bit on Track 1 as illustrated in Figure B-3. In addition to head misalignment, the skew is also affected by the position of the tape cartridge lock lever. Since the pinch roller is pivoted at a point under the cartridge, the roller makes contact with the lower portion of the tape before, and more firmly than with, the upper edge of the tape. The resulting uneven pressure apparently distorts the tape motion across the head resulting in skew. On the tape reader, lever position adjustment can result in variations in skew of as much as 15%.

Obviously, with variations in skew, a fixed read window size could result in invalidating data that could be salvaged, at least in part, by making the window adjustable to electronically compensate for the mechnically induced skew.

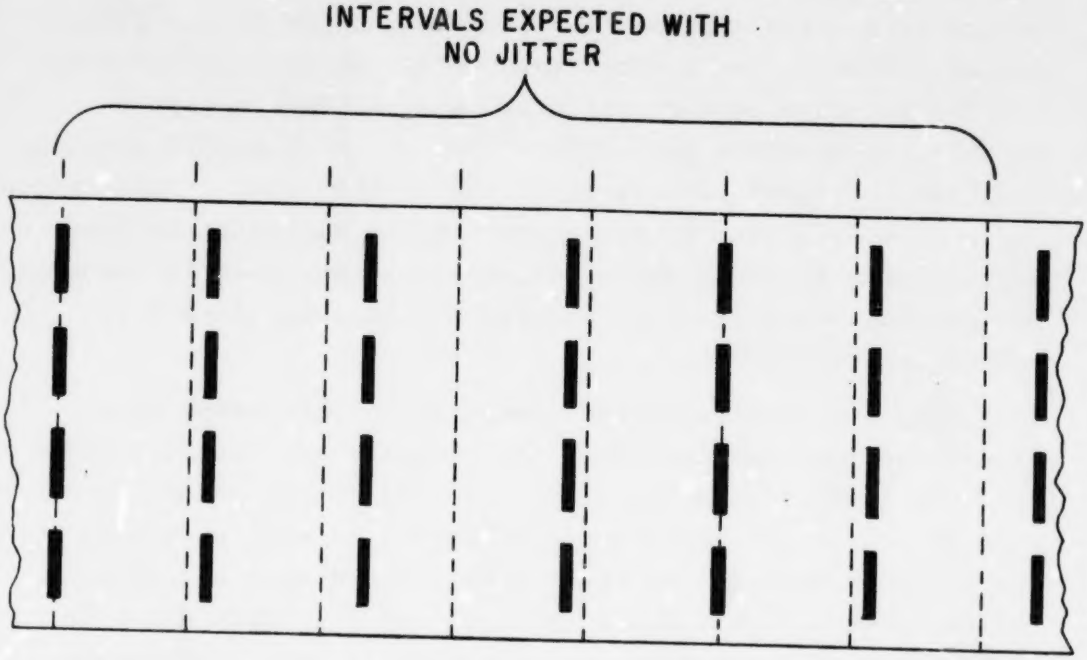

INTERVALS EXPECTED WITH NO JITTER

ILLUSTRATION OF TAPE JITTER

Figure B-2

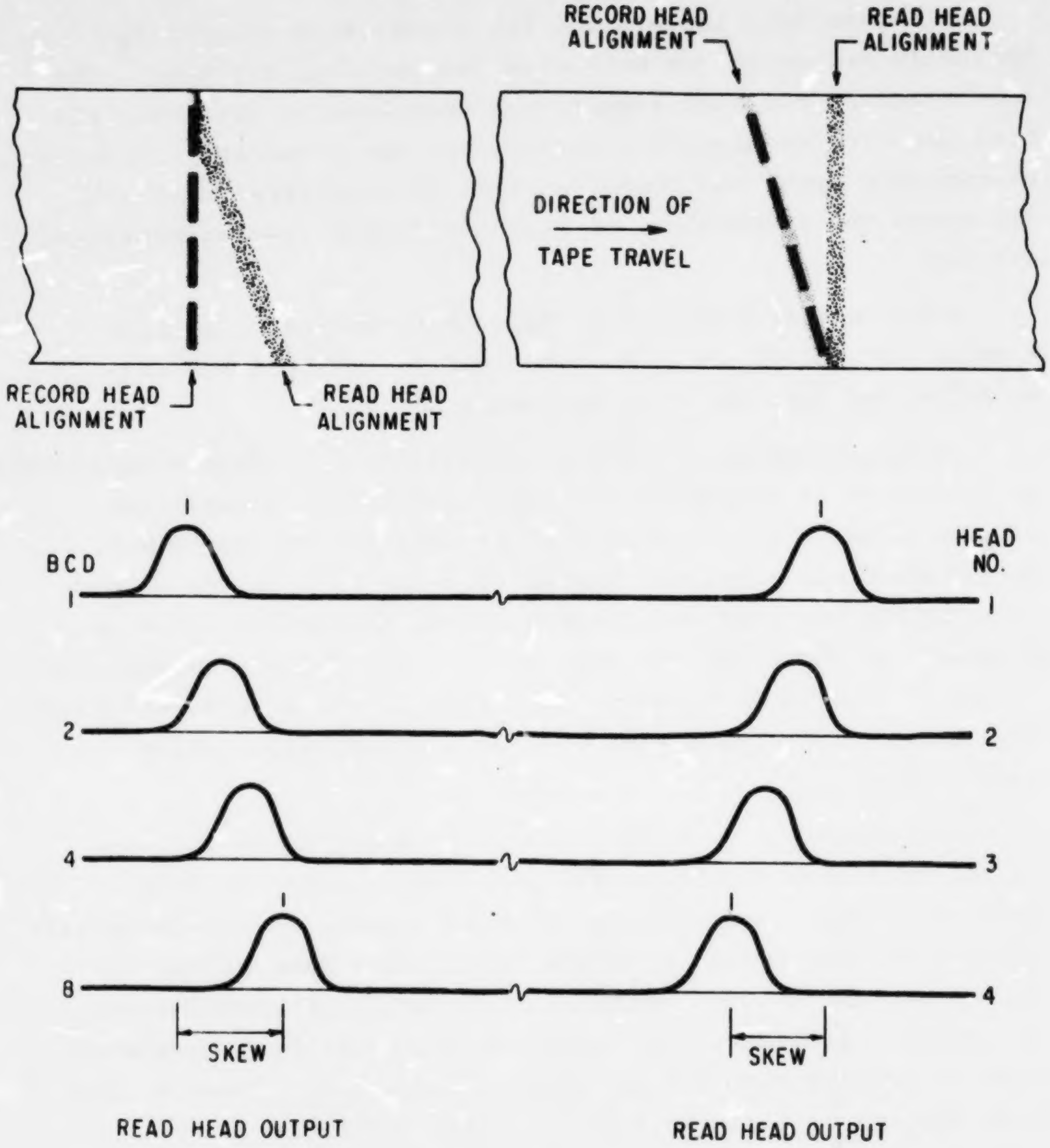

RECORD HEAD ALIGNMENT
READ HEAD ALIGNMENT
DIRECTION OF TAPE TRAVEL
RECORD HEAD ALIGNMENT
READ HEAD ALIGNMENT
BCD
HEAD NO.
1
2
4
8
1
2
3
4
SKEW
SKEW
READ HEAD OUTPUT
READ HEAD OUTPUT

ILLUSTRATION OF EFFECT OF HEAD ALIGNMENT OR SKEW

Figure B-3

Wilbur Smith and Associates

All five data loggers and the reader were aligned by Metrodata personnel for both skew and vertical tracking. The tape speed of the data loggers was increased to precisely 150 bits per inch to alleviate jitter and skew problems. This change allows more space and therefore time between characters and decreases the probability of skew and jitter causing character overlap.

Loggers were modified by Wyle Laboratories to provide a metal cover over the cassette, holding cassette securely in place and tape securely against head.

Misregistration - Vertical misalignment of tape with respect to record or reader heads can cause reduction in amplitude of data read. This condition is illustrated in Figure B-4. Metrodata field personnel installed metal tabs on the guides to position the tape as it moves across the heads. This is supposed to stabilize the tape and prevent changes in vertical alignment caused by cassette insertion in the loggers and reader. Apparently, these tabs were omitted inadvertently during manufacture.

Data Levels - In some cases a bit recorded on the tape is not read at a strong enough level to trigger the peak detector. This can be caused by misalignment of data bits with respect to read heads, possibly from uneven tape width, misplaced tape guides, vertical dislocation of record heads or cassette problems. Low levels also result from excessive tape to head gaps caused by oxide buildup, dirt, insufficient tape tension or improper cassette construction.

It should be remembered that the recording is in a complemented format, wherein the absence of a bit on tape is indicative of a bit in the actual data recorded. Thus, data bits not read for any of the above reasons are confused with

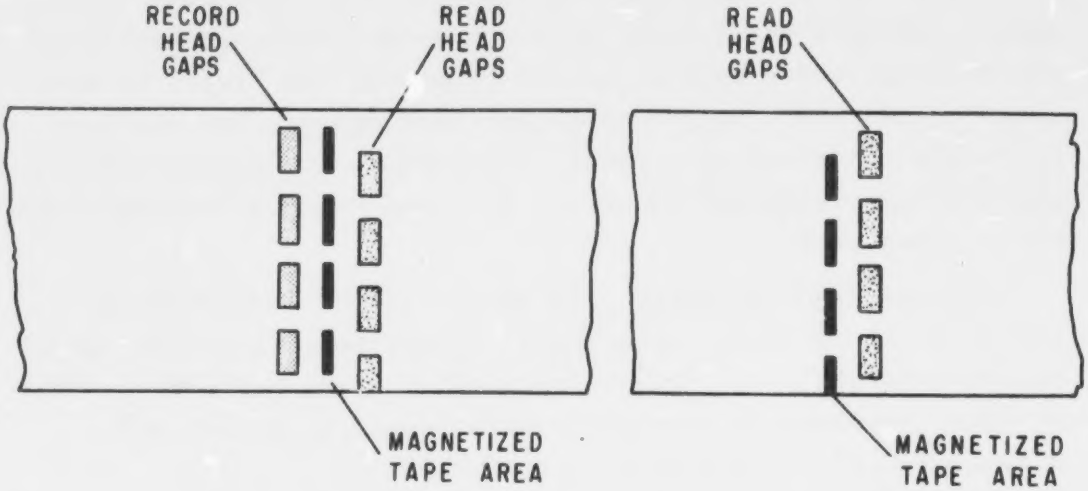

RECORD HEAD GAPS
READ HEAD GAPS
MAGNETIZED TAPE AREA
READ HEAD GAPS
MAGNETIZED TAPE AREA

ILLUSTRATION OF MISREGISTRATION

Figure B-4

data bits purposely lacking, resulting in erroneous data, incorrect sign, incorrect preparity, or any combination of such errors.

The correction of this deficiency was accomplished electronically by modifying the reader. The individual bit amplifiers were modified to allow adjustment of gain to bring all bit amplitudes to same level. Further, the timing of the ready pulse, which outputs data to the computer, was modified to permit a continuous range of adjustment. This modification permits the adjustment to be set to yield maximum readable data for a given tape.

Reader Clock Problems - In the course of investigating the cause of excessive zero scans, it was noted that the output of the internal clock was low in amplitude and distorted. This, in turn, resulted in missing or erratic timing pulses and ultimately in zero scans being generated.

A new master clock for the reader was designed and installed to replace the original circuitry.

Cassettes - In general, it can be stated that the tape cassettes are not of sufficient quality for their intended purpose. The variance from cassette to cassette aggravates the previously detailed problems and makes tape handling critical. It appears that some data has been and will continue to be lost because of imperfect cassettes.

Although difficult to define completely, the cassette imperfections include (1) imperfections in the coating, resulting in dropouts, (2) variations in tape width resulting in misregistrations relative to the record/read head and (3) variations in spool packing density which aggravates the erratic tape motion problem due to variations in tension. The spool packing density also seems to vary under vibration, as well as simply due to continuous running of the endless loop cassettes.

As a partial corrective measure, all cassettes were returned to Metrodata for rewinding to correct packing density. A quick rewind unit was obtained to permit this operation in the field.

APPENDIX C

EVALUATION AND IMPROVEMENT PROGRAM - ZERO SCAN EVALUATION AND ACCEPTANCE CRITERIA DEVELOPMENT

A study was undertaken during the evaluation and improvement program to determine the effect of zero scans in data on vehicle mode determination. This was necessary, not only to judge which data collected during the 1973 field survey operations, but also to establish a base for acceptance of data to be subsequently generated.

Three factors were considered in this study. The effects, singularly and in combination, were included:

- Percent of total scans which were zero scans.
- Number of consecutive zero scans.
- Distribution of zero scans.

Evaluation Procedure

The primary intended purpose of survey data was that of determining the vehicle mode of operation to define its pattern and use. A mode determination program had been developed to perform this process by fixed logic. The influence of zeroed scans with the data could be determined heuristically by selecting a sample of actual field data with very low zero scans. These data were then processed through the mode determination program and the results analyzed statistically.

Under appropriately controlled conditions, a series of similar mode statistics could be run on the same data, except that random data sets were artificially generated with various patterns of consecutive and non-consecutive zeroed scans. The sensitivity of these events could then be determined by testing the significance of the differences in modes produced by the base pattern generated from ideal data and those from artificially controlled data.

The test was performed on field data recorded on truck number 3, day 2. These data had an initial 0.6 percent random zero scan error rate.

Matrices of mode pattern were generated both from the ideal data and with those data sets generated from artificial errors introduced into the ideal data. Both random non-consecutive and block of errors were introduced. The following patterns and percent zero scans were employed in the test:

1. Ideal (or base) mode matrix with 0.6% non-consecutive zero scans (noted: 0.6/1+)
2. Mode matrix with 5.6% non-consecutive zero scans (noted: 0.6/1+)
3. Mode matrix with 10.6% non-consecutive zero scans noted: 10.6/1+)
4. Mode matrix with 5.6% zero scans, in randomly placed groups of 14 consecutive scans (noted: 5.6/14)
5. Mode matrix with 5.6% zero scans, in randomly placed groups of 50 consecutive scans (noted: 5.6/50)
6. Mode matrix with 10.6% zero scans, in randomly placed groups of 14 consecutive scans (noted: 10.6/14)
7. Mode matrix with 10.6% zero scans, in randomly placed groups of 50 consecutive scans (noted: 10.6/50)
8. Mode matrix with 20% zero scans, in randomly placed groups of 100 consecutive scans (noted: 20.0/100)
9. Mode matrix with 25% non-consecutive zero scans (noted: 25.0/1+)

Cruise mode frequency, acceleration mode frequency and deceleration mode frequency matrices for these 9 patterns are shown in Tables C-2, C-3, and C-4.

The statistical test applied to these matrices was the Kolmogorov-Smirnov Test.* Basically, the test evaluates the significance of differences between observed and expected results and establishes whether this difference is significant enough to warrant rejection of the hypothesis that the two distributions are similar. The steps of the test are summarized in Table C-1.

The first use of this test was performed on the mode frequency matrix, with results found in Table C-2. The table shows that only a 25 percent zero scan would be rejected. All other observed distributions had statistically similar proportions of mode changes. See Tables C-3 and C-4.

An important note here is that the observed distributions are created by randomly introducing zeros in the "base" data. Therefore, another run of, say, 5.6 percent zero scan would produce a different cumulative matrix thus the maximum difference may change. This difference could go either up or down. Hence, there is a confidence level around each distribution in which the Kolmogorov-Smirnov statistic (K.S.S.) would vary. However, since the K.S.S. reported in Table C-5 are so far below that needed for rejection, it is highly unlikely that in N random runs at the zero scan levels there would ever be one that failed the test, except at the 25 percent level.

A second point to consider here is that the Kolmogorov-Smirnov test can produce varied results if the distributions are summed differently. Therefore, to strengthen first test,

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*Statistical Theory, Lindgren, B. W., The MacMillan Company, 1968, pp. 329-333.

Table C-1

KOLMOGOROV - SMIRNOV TEST PROCEDURE

1. Determine the expected matrices, 0.6% zero scan (ideal or reference).

2. Determine the observed matrices by introducing random zero scans to levels of 5.6%, 10.6%, etc.

3. Equate the observed to the expected, proportioned so cumulative scans are approximately the same in all cases.

4. Determine cumulative matrices = cf.

5. Determine the differences in observed and expected.

6. Take absolute maximum difference:

$$d = \max \left(F_o (x) - F_e (x)\right)$$

7. Determine confidence level 99, 95, etc. and look up value Z at the cf.

8. Calculate $D_n = \frac{d}{cf}$

9. If $D_n < Z \rightarrow$ accept;

   $D_n \geq Z \rightarrow$ reject.

Table C-2

KOLMOGOROV - SMIRNOV TEST
CRUISE MODE FREQUENCY MATRIX

SPEED	PER CENT ZERO/PATTERN								
From To (MPH)	.6/1+	5.6/1+	10.6/1+	5.6/14	5.6/50	10.6/14	10.6/50	20.0/100	25.0/1+
0.0 - 5.0	22	23	20	21	22	19	21	20	18
5.1 - 10.0	10	10	9	10	8	9	8	9	9
10.1 - 15.0	60	58	55	59	60	55	54	53	51
15.1 - 20.0	95	94	91	91	87	86	86	75	78
20.1 - 25.0	84	83	78	77	80	76	74	67	72
25.1 - 30.0	55	55	55	53	53	52	49	38	53
30.1 - 35.0	27	26	26	27	27	24	26	25	26
35.1 - 40.0	19	20	19	18	18	18	17	16	19
40.1 - 45.0	10	10	10	9	10	10	9	8	10
45.1 - 50.0	0	0	0	0	0	0	0	0	0
50.1 - 55.0	0	0	0	0	0	0	0	0	0
55.1 - 60.0	0	0	0	0	0	0	0	0	0
60.1 - 65.0	0	0	0	0	0	0	0	0	0
65.1 - 70.0	0	0	0	0	0	0	0	0	0
70.1 - 75.0	0	0	0	0	0	0	0	0	0
75.1 - 80.0	0	0	0	0	0	0	0	0	0
80.1 - UP	0	0	0	0	0	0	0	0	0
Total Frequency	382	379	363	365	365	349	344	311	336

+ Non-Sequential zeros.

Table C-3

KOLMOGOROV - SMIRNOV TEST
ACCELERATION MODE FREQUENCY MATRIX

INTENSITY From	To	PER CENT ZERO/PATTERN .6/1+	5.6/1+	10.6/1+	5.6/14	5.6/50	10.6/14	10.6/50	20.0/100	25.0/1+
0.0 -	0.5	83	88	102	84	83	87	85	78	120
0.6 -	1.0	52	56	50	53	49	58	50	36	48
1.1 -	1.5	58	51	52	55	59	47	53	46	51
1.6 -	2.0	33	31	30	33	32	32	30	26	35
2.1 -	2.5	33	36	36	33	31	33	29	29	35
2.6 -	3.0	43	46	44	40	42	46	39	36	38
3.1 -	3.5	42	38	39	40	41	33	35	31	39
3.6 -	4.0	31	30	33	29	30	29	27	27	28
4.1 -	5.0	50	50	49	48	48	41	45	38	53
5.1 -	6.0	34	32	38	30	33	30	26	26	33
6.1 -	7.0	21	21	14	19	20	17	19	16	15
7.1 -	8.0	17	19	16	16	15	13	16	15	21
8.1 -	9.0	12	12	17	12	10	10	12	9	13
9.1 -	10.0	11	11	7	11	11	10	10	8	9
10.1 -	11.0	8	7	7	8	8	7	8	7	5
11.1 -	12.0	4	4	4	4	5	3	4	3	3
12.1 -	15.0	1	1	1	1	0	1	0	1	1
15.1 -	20.0	0	0	0	0	0	0	0	0	0
20.1 -	UP	0	0	0	0	0	0	0	0	0
Total Frequency		533	533	539	516	517	497	488	432	547

- Non-Sequential zeros.

Table C-4

KOLMOGOROV - SMIRNOV TEST
DECELERATION MODE FREQUENCY MATRIX

INTENSITY		PER CENT ZERO/PATTERN								
From	To	.6/1+	5.6/1+	10.6/1+	5.6/14	5.6/50	10.6/14	10.6/50	20.0/100	25.0/1+
0.0 -	0.5	28	32	45	32	29	33	25	22	44
0.6 -	1.0	27	28	22	25	28	21	27	23	25
1.1 -	1.5	20	20	14	18	18	20	19	16	18
1.6 -	2.0	20	20	20	19	19	17	20	16	17
2.1 -	2.5	14	13	14	12	12	14	14	9	16
2.6 -	3.0	16	15	20	15	16	14	14	12	14
3.1 -	3.5	15	11	14	16	14	13	14	11	21
3.6 -	4.0	20	21	17	19	20	19	17	17	12
4.1 -	5.0	21	24	26	19	19	20	17	16	20
5.1 -	6.0	26	22	22	24	25	23	22	19	24
6.1 -	7.0	17	20	20	18	16	12	16	11	19
7.1 -	8.0	13	11	10	13	13	12	11	11	12
8.1 -	9.0	9	9	7	9	8	9	8	8	5
9.1 -	10.0	2	2	5	1	1	2	2	2	2
10.1 -	11.0	3	3	1	3	2	2	3	2	3
11.1 -	12.0	2	4	2	2	2	3	2	2	1
12.1 -	15.0	2	1	2	2	2	2	2	2	0
15.1 -	20.0	1	1	0	1	1	1	1	1	0
20.1 -	UP	0	0	0	0	0	0	0	0	0
Total Frequency		256	257	261	248	245	237	234	200	253

+ Non-Sequential zeros.

Table C-5

KOLMOGOROV - SMIRNOV TEST 1

	ZERO %	PATTERNS BLOCKS	MAX. DIFF. D_n	K.S.S.+	RUN STATUS
1.	.6	Non-Consecutive	-	.040++	Base
2.	5.6	Non-Consecutive	8	.005	Accept
3.	5.6	14	11	.007	Accept
4.	5.6	50	4	.002	Accept
5.	10.6	Non-Consecutive	29	.020	Accept
6.	10.6	14	8	.005	Accept
7.	10.6	50	10	.006	Accept
8.	20.0	100	9	.006	Accept
9.	25.0	Non-Consecutive	83	.050+++	Reject

+ K.S.S. - Kolmogorov-Smirnov Statistic.
++ .040 - K.S.S. value determined from tables at 99% = 8
+++.050 $>$ .040 therefore reject.

K-S tests were run on the cruise, acceleration, and deceleration mode matrices. These frequency matrices are accumulated by speeds and intensities; therefore, they are summed accordingly. The results of these analyses are given in Table C-5, and verifies generally the first test. However, a zero scan rate of 20 percent in blocks of 100 consecutive scans approaches the "reject" criterion at a 99 percent confidence level.

Conclusions

It is possible to conclude from these results that data tapes containing zero scans less than or equal to 10 percent can safely be accepted for analysis, and will produce results that are _not_ significantly different from data tapes with a zero error rate. Tapes of even higher zero scans could be accepted if so desired. However, it was recommended that a 10 percent level be assumed a sufficient cut-off point. In the actual survey data, this level was not approached in tapes that were recorded on good operable equipment.

Appendix D
HORSEPOWER MODEL DEVELOPMENT

Conversion of the recorded load factor measurements to wheel horsepower is prerequisite to defining vehicle modes. For this reason, each installation was calibrated on a chassis dynamometer under controlled conditions, recording load factor indications (sensor voltages) at various fixed condition of wheel horsepower and engine speed (rpm). The development of a mathematical model to establish the relationship between wheel horsepower, the dependent variable, and the independent variables of engine speed and load factor measurment appeared to be relatively straightforward, but proved to be a much more complex, if not indeed, a pioneering effort.

Original Model

Original assumptions were made, based on the best information from industry, that the relationship between load factor (intake manifold pressure for gasoline engines, or rack position or rail pressure derived from the fuel injection system of diesel engines) was a quadratic equation form with linear relationship between horsepower and engine rpm. An original model was proposed and developed based on these assumptions. Field calibration of survey trucks run in 1973 (through truck number 20 and bus number 83) involved the recording of 9 data points (at 3 constant speeds with horsepower at maximum, ½ load, and minimum).

Horsepower models developed from these calibration data were employed to process field data on a sample basis. The results did not meet the test of reason for a number of observations. Most obvious was the condition where wheel horsepower indications other than zero were developed by the model when the vehicle was known to be at rest.

Secondly, the vehicle engine operates in two distinct modes - a driving mode when the engine output is positive, and a motoring mode when the engine is in the dynamic braking or torque absorption mode principally during decelerations. While the horsepower model generally produced negative horsepower indications employing the model derived from only driving mode calibrations on a Clayton dynamometer, the accuracy of the magnitude of this horsepower projection was subject to question.

At this point, another question was reintroduced into the program. Although the Phase II program was proposed and approved as a vehicle mode profile approach employing wheel horsepower, the output of this phase was to be employed by the government to produce an engine dynamometer test cycle. How could engine (clutch plate) horsepower be related to wheel horsepower? Even though there had been previous general discussion of this point in the past, it was considered beyond the scope of this program.

During the development of the work plan, many alternative technical approaches to the truck instrumentation procedure were evaluated. It was recognized that a torque cell in the drive train, for instance, would have been preferable to a chassis dynamometer calibration, greatly simplifying the calibration procedure and eliminating part of the drive train losses. However, two main problems mitigated against this approach. First, the installation of this sensor in the variety of truck configurations would have been tailored to each vehicle and therefore very costly and time consuming. Second, the nature of the sensor cell provides unsatisfactory oscillations in output under transient loads in field operations. Wheel horsepower with chassis dynamometer calibration was the approved approach, not withstanding the undetermined drive train losses between wheel and engine.

Original Horsepower Model

In the original horsepower model development, three families of load factor analog voltage outputs (x), were taken. Each of these families consist of the X-values for three different wheel loads, nominally high output near maximum output for that RPM, a medium load, and zero or idle condition. Let those engine loads at each RPM be denoted:

HP_{nm}
Where n signifies the RPM grouping thus:
n=1 {HP @ 1200 rpm}
n=2 {HP @ 1600 rpm}
n=3 {HP @ 2000 rpm}
m signifies the specific load condition thus:
m=1 {High load}
m=2 {Medium load}
m=3 {minimum load}

Following the same notation, write the analog load factor as X_{nm}.

It is assumed that these variables (X_{nm}) are related to wheel horsepower in the general equation:

$$HP_{nm} = a_n X_{nm}^2 + b_n X_{nm} + c_n$$

The calibrate program takes the 9 calibration data points and calculates the constants a_n, b_n, c_n by the following relationships:

$$a_n = \frac{(HP_{ni} - H_{n2}) \quad (X_{n2} - X_{n3}) - (HP_{n2} - HP_{n3}) \quad (X_{ni} - X_{n2})}{(X_{ni}{}^2 - X_{n2}{}^2) \quad (X_{n2} - X_{n3}) - (X_{n2}{}^2 - X_{n3}{}^2) \quad (X_{ni} - X_{n2})}$$

$$b_n = \frac{(HP_{ni} - HP_{n2}) - A_n \; (X_{ni}{}^2 - X_{n2}{}^2)}{(X_{ni} - X_{n2})}$$

$$c_n = HP_{ni} \; A_n \; X_{ni}{}^2 - b_n \; X_{ni}$$

The constants for each given calibrate RPM (n=1, 2, and 3) are determined through the application of a least-squares quadratic routine and arrayed by rpm into a 3 x 3 matrix. These are then solved for least-squares linear fit to calculate a_a, b_a, a_b, b_b, a_c, and b_c.

The coefficients of the quadratic horsepower model, A, B, and C were then computed:

$A = a_a \; (RPM) + b_a$

$B = a_b \; (RPM) + b_b$

$C = a_c \; (RPM) + b_c$

The horsepower model then was:

$HP = A_x{}^2 + B_x + C$

Revised Horsepower Model

The basic component of the model used in the revised horsepower model was the step-wise regression program originally developed at the Health Science Computing Facility, University of California, Los Angeles, and modified by Wilbur Smith and Associates for use on the IBM system 360.

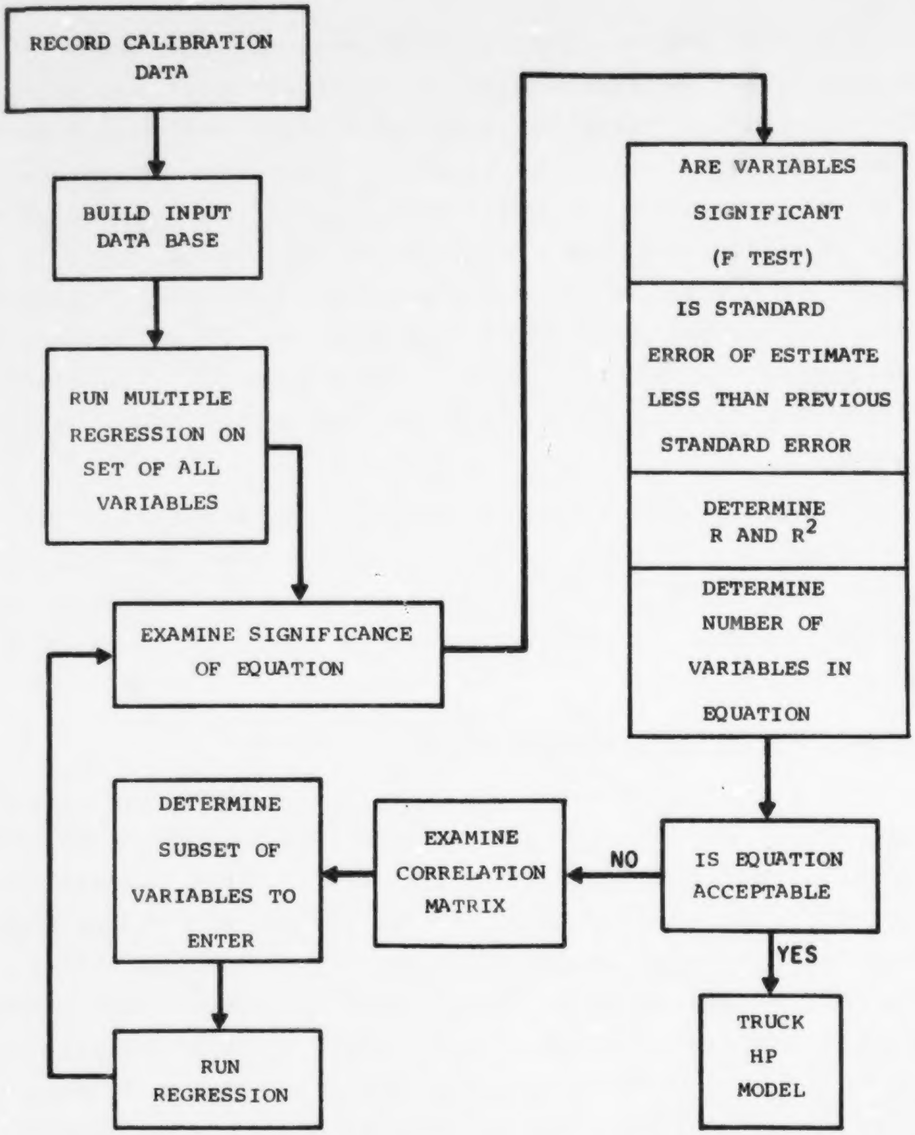
The program computes a sequence of equations by statistically determining which power or cross product of the independent variables are significant and should be included at each step. The term or terms which contributes the most to predicting the observed values of the dependent variable of horsepower are accepted. A statistical test is performed to determine its significance. The test includes: correlation, standard error of estimate, "F" values for the coefficients of the variables, and the correlation squared. Figure D-1 schematically outlines the entire model development.

An equation based on the initial regression run allowing all variables to enter may not meet criteria for model acceptance. A detailed analysis after the first run and all succeeding runs determined the significance of each model.

Horsepower Model Investigations

A special program was instituted by Wilbur Smith and Associates; the subcontractor, Wyle Laboratories; and the Ann Arbor Office of Air Programs, EPA. Three calibration procedures were conducted. Two of these, run on the Chassis Electrodynamometer in the EPA Laboratories, collected very comprehensive data on an EPA Heavy-Duty gasoline truck under driving and motoring mode conditions. A third calibration was conducted on a water-load dynamometer (Clayton) to simulate a field calibration. Two road tests were run to obtain typical survey-type data on a test route familiar in characteristics to the EPA.

Another analysis was conducted, using EPA published data for 4 engine types, to determine the adequacy of a 9-point model in predicting horsepower.


RECORD CALIBRATION DATA
BUILD INPUT DATA BASE
RUN MULTIPLE REGRESSION ON SET OF ALL VARIABLES
EXAMINE SIGNIFICANCE OF EQUATION
ARE VARIABLES SIGNIFICANT (F TEST)
IS STANDARD ERROR OF ESTIMATE LESS THAN PREVIOUS STANDARD ERROR
DETERMINE R AND R²
DETERMINE NUMBER OF VARIABLES IN EQUATION
IS EQUATION ACCEPTABLE
NO
YES
EXAMINE CORRELATION MATRIX
DETERMINE SUBSET OF VARIABLES TO ENTER
RUN REGRESSION
TRUCK HP MODEL

HORSEPOWER MODEL DEVELOPMENT

Wilbur Smith and Associates

FIGURE D-1

Electrodynamometer Driving and Motoring Model - Using a large selected number of calibration points for both the driving and motoring engine conditions, a single model was created:

Model 1 - Electrodynamometer Driving and Motoring Mode

$$HP = 40.66525\ (RPM)^2\ (X)^2\ (10^{-6}) - 46.4883\ (RPM)^2\ (X)\ (10^{-6})$$
$$+ 0.06914\ (RPM^2)\ (10^{-4}) - 0.06477\ (RPM)$$
$$+ 0.28312\ (RPM)\ (X) - 0.16564\ (RPM)\ (X)^2 - 15.73058$$

This model was used to create plots of horsepower versus manifold vacuum analog voltage (X) for 7 constant engine speeds, shown in Figure D-2, and plots of horsepower versus engine speed (RPM) for 13 constants manifold vacuum analog voltages (X), as shown in Figure D-3. Calibration points for both driving and motoring conditions were used to generate this model.

Electrodynamometer Driving Only Model - A model was created using 60 selected calibration points from the driving conditions:

Model 2 - Electrodynamometer Driving Mode - Data Points

$$HP = -0.05953\ (RPM)^2\ (10^{-4}) + 0.06970\ (RPM) - .112542$$
$$(RPM)\ (HG) + 0.0697078\ (HG) - 25.77850$$

This model was used to plot corresponding horsepower versus manifold vacuum and horsepower versus engine speed curves shown in Figures D-4 and D-5. Calibration points from only the driving runs were used to generate this model.

Clayton Driving Mode Only Model - This model was created using 35 calibration points obtained from the Clayton dynamometer calibration:

Model 3 - Clayton Dynamometer Driving Mode - Data Points

$$HP = -\ 0.07664\ (RPM)^2\ (10^{-4}) - 0.04069\ (RPM) + 0.14007$$
$$(RPM)\ (X) - 109.00630\ (X) + 47.72499$$

This model provides the corresponding two curves as shown in Figures D-6 and D-7. Model generation was comparable to Model 2 above.

GASOLINE ENGINE HORSEPOWER MODEL DEVELOPMENT

MODEL 1 – ELECTRODYNAMOMETER DRIVING AND MOTORING MODE DATA

CURVE 1 – H. P. VERSUS MANIFOLD VACUUM ANALOG VOLTAGE
FOR CONSTANT ENGINE RPM'S

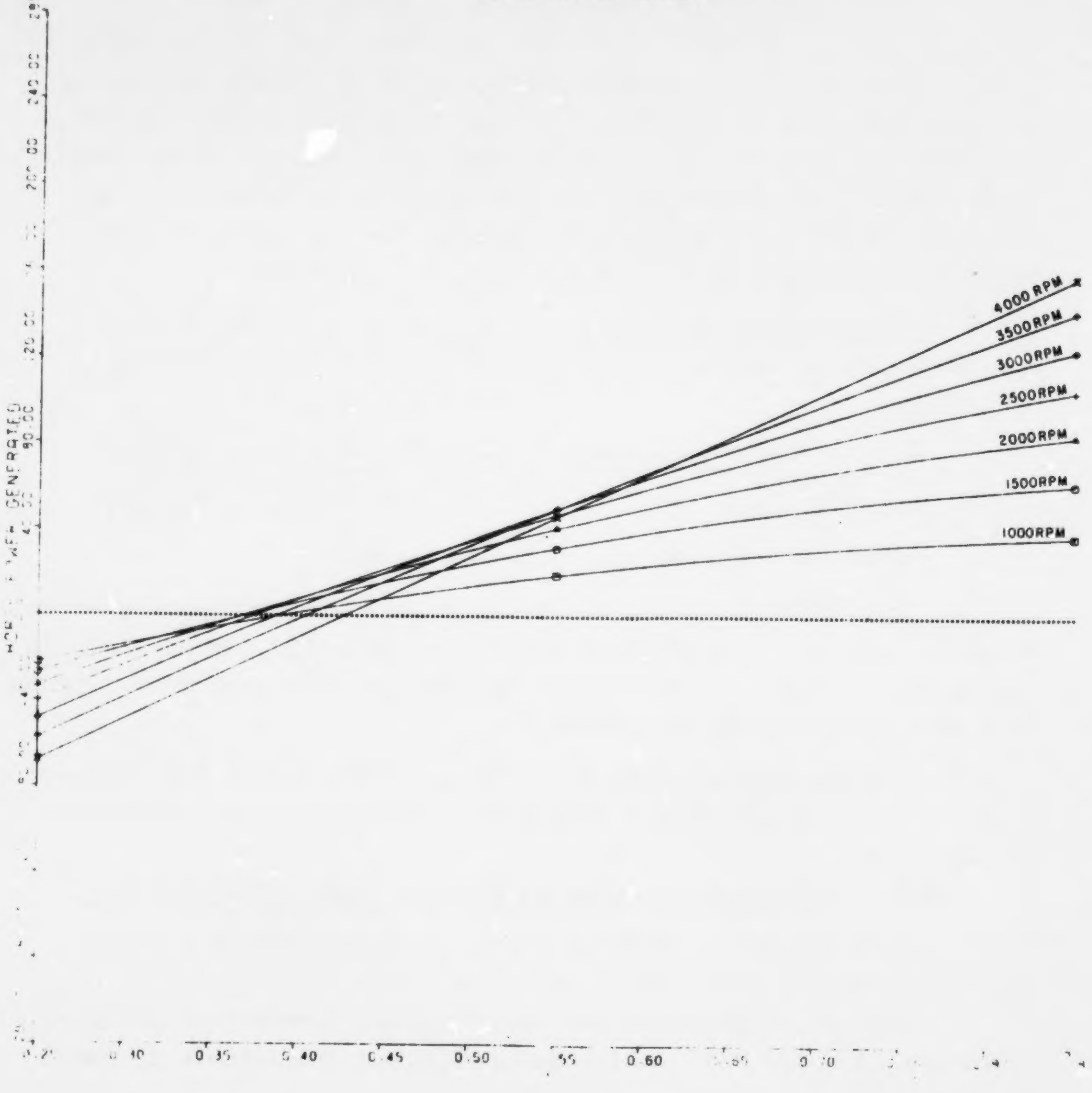


FIGURE D-2

GASOLINE ENGINE HORSEPOWER MODEL DEVELOPMENT

MODEL 1 – ELECTRODYNAMOMETER DRIVING AND MOTORING MODE DATA

CURVE 2 - H P. VERSUS ENGINE RPM FOR CONSTANT MANIFOLD VACUUM ANALOG VOLTAGES

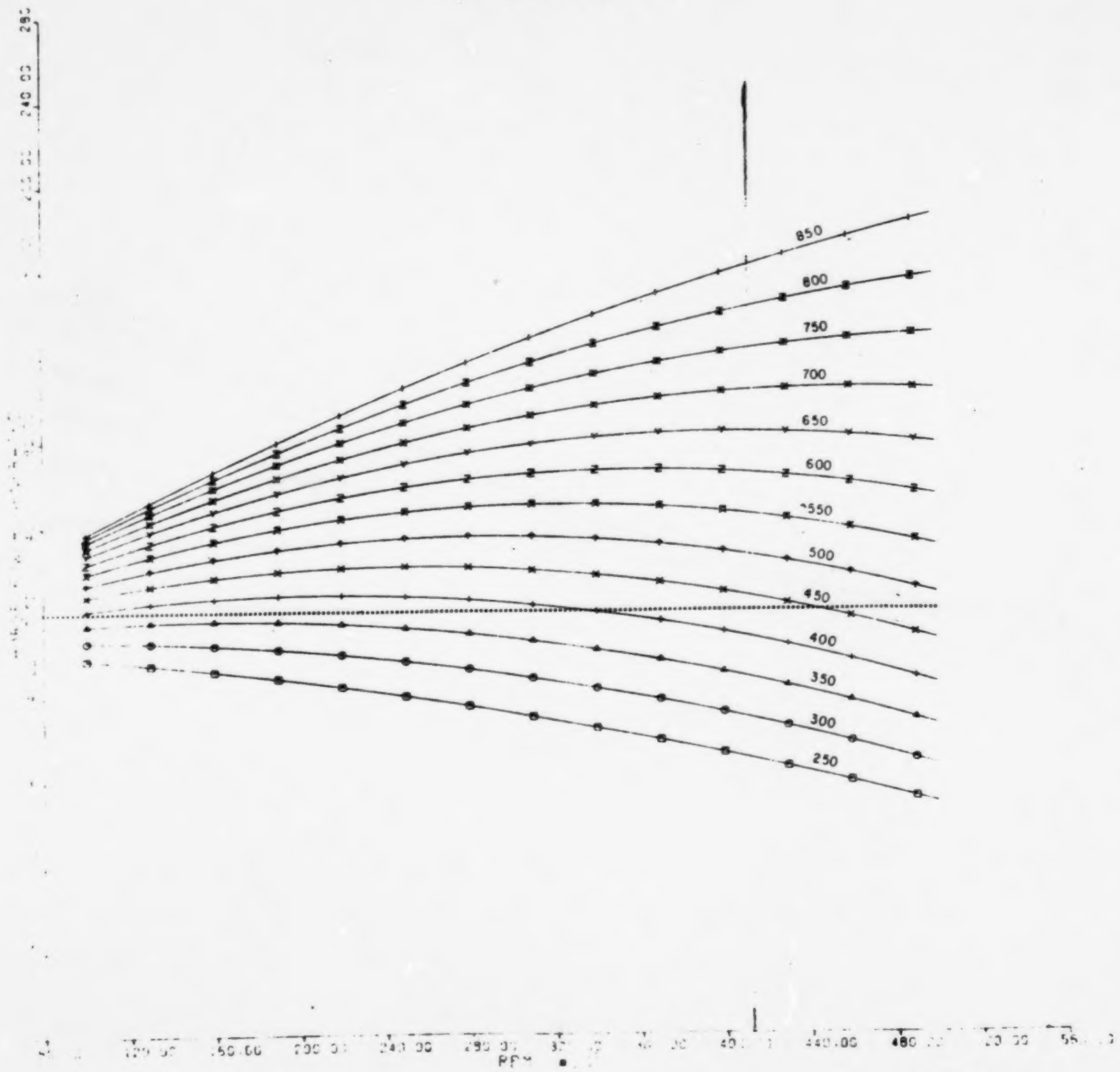


FIGURE D-3

GASOLINE ENGINE HORSEPOWER MODEL DEVELOPMENT
MODEL 2 – ELECTRODYNAMOMETER DRIVING
MODE DATA ONLY
CURVE 3 – H. P. VERSUS MANIFOLD VACUUM ANALOG VOLTAGE
FOR CONSTANT ENGINE RPM'S

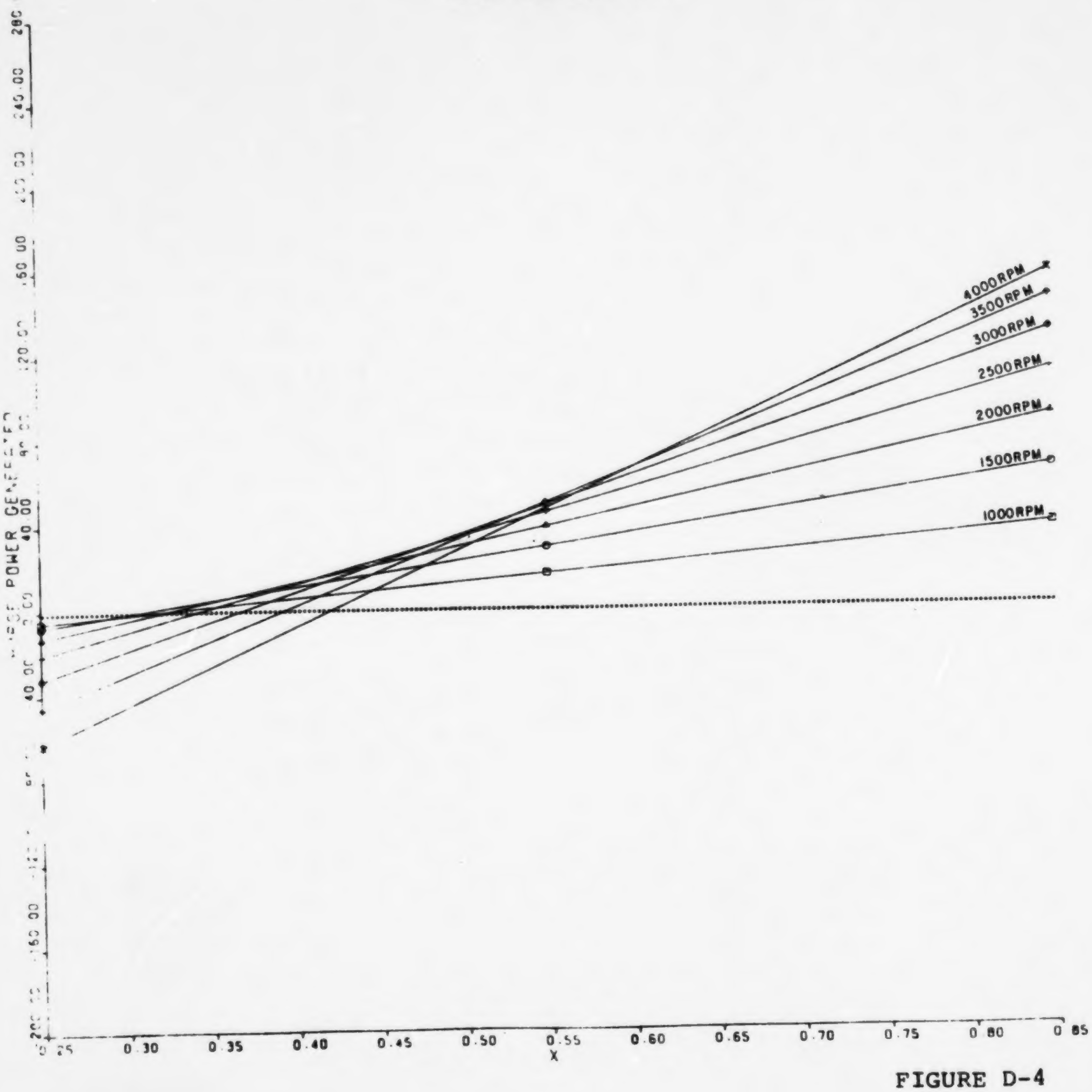


FIGURE D-4

GASOLINE ENGINE HORSEPOWER MODEL DEVELOPMENT
MODEL 2 – ELECTRODYNAMOMETER DRIVING
MODE DATA ONLY
CURVE 4 – H. P. VERSUS ENGINE RPM FOR CONSTANT MANIFOLD
VACUUM ANALOG VOLTAGES

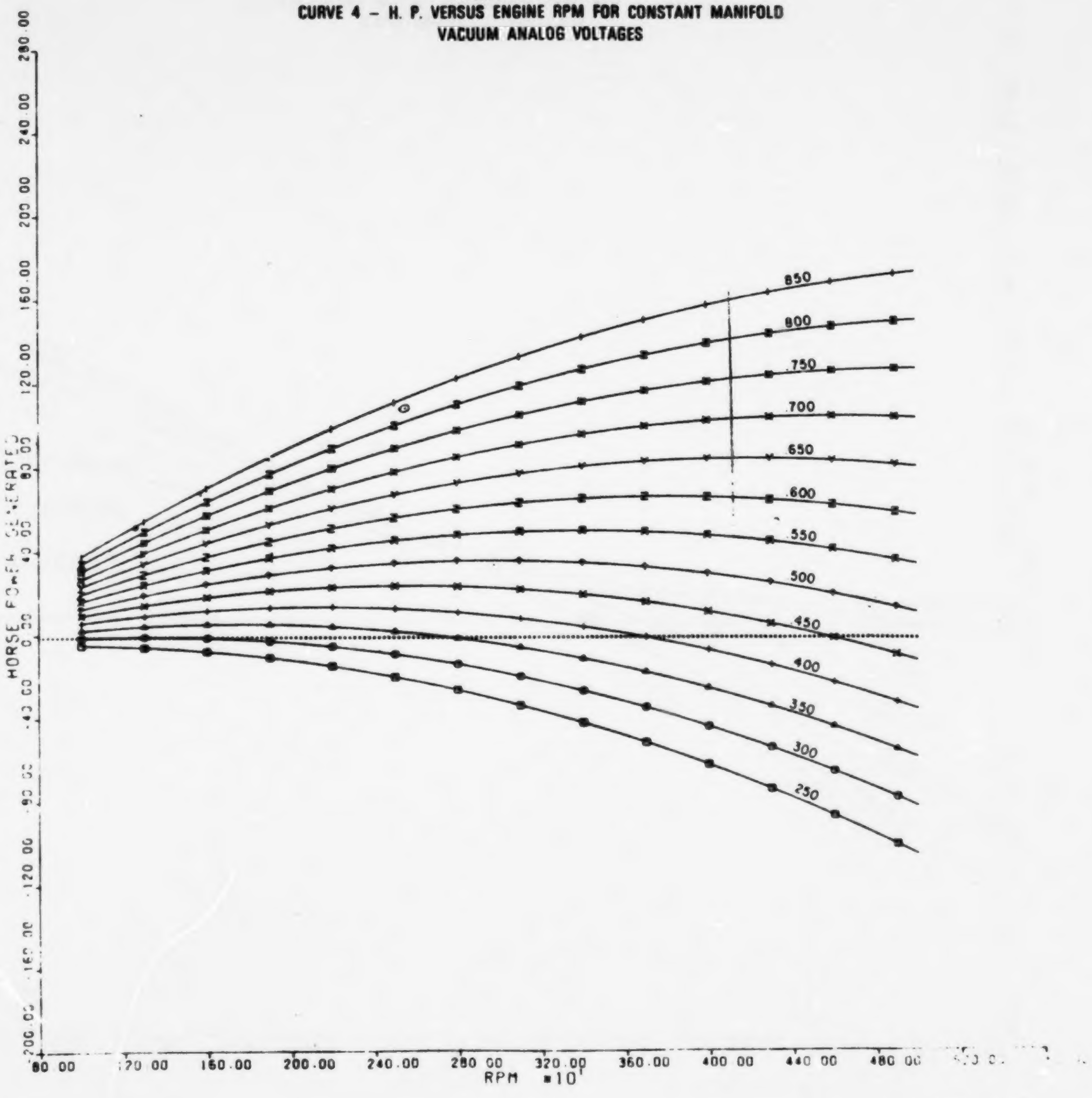


FIGURE D-5

GASOLINE ENGINE HORSEPOWER MODEL DEVELOPMENT

MODEL 3 – WATER LOAD (CLAYTON)
DYNAMOMETER DRIVING MODE DATA

CURVE 5 – H. P. VERSUS MANIFOLD VACUUM ANALOG VOLTAGE
FOR CONSTANT ENGINE RPM'S

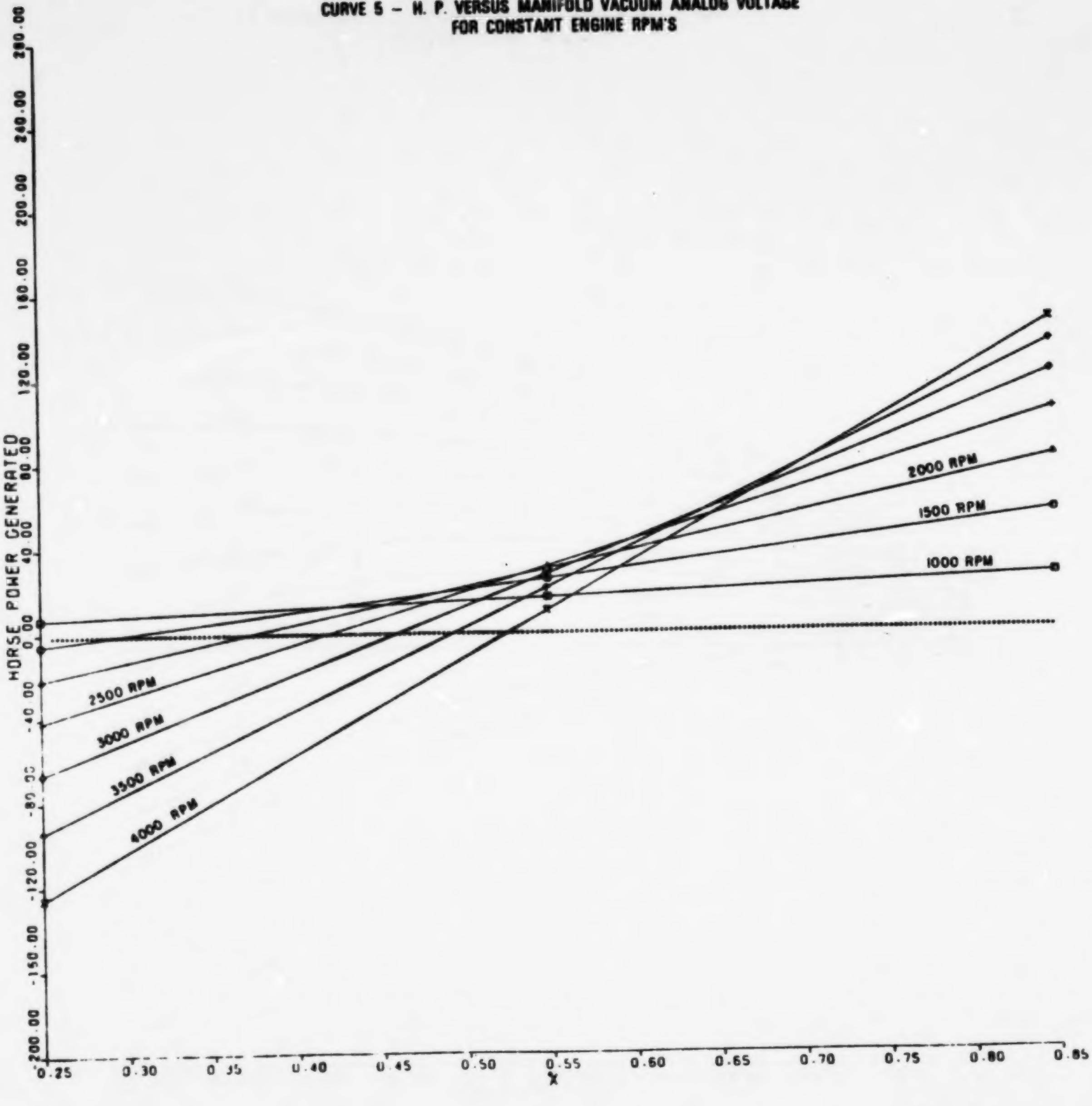


FIGURE D-6

GASOLINE ENGINE HORSEPOWER MODEL DEVELOPMENT

MODEL 3 – WATER LOAD (CLAYTON)
DYNAMOMETER DRIVING MODE DATA

CURVE 6 – H. P. VERSUS ENGINE RPM FOR CONSTANT MANIFOLD
VACUUM ANALOG VOLTAGES

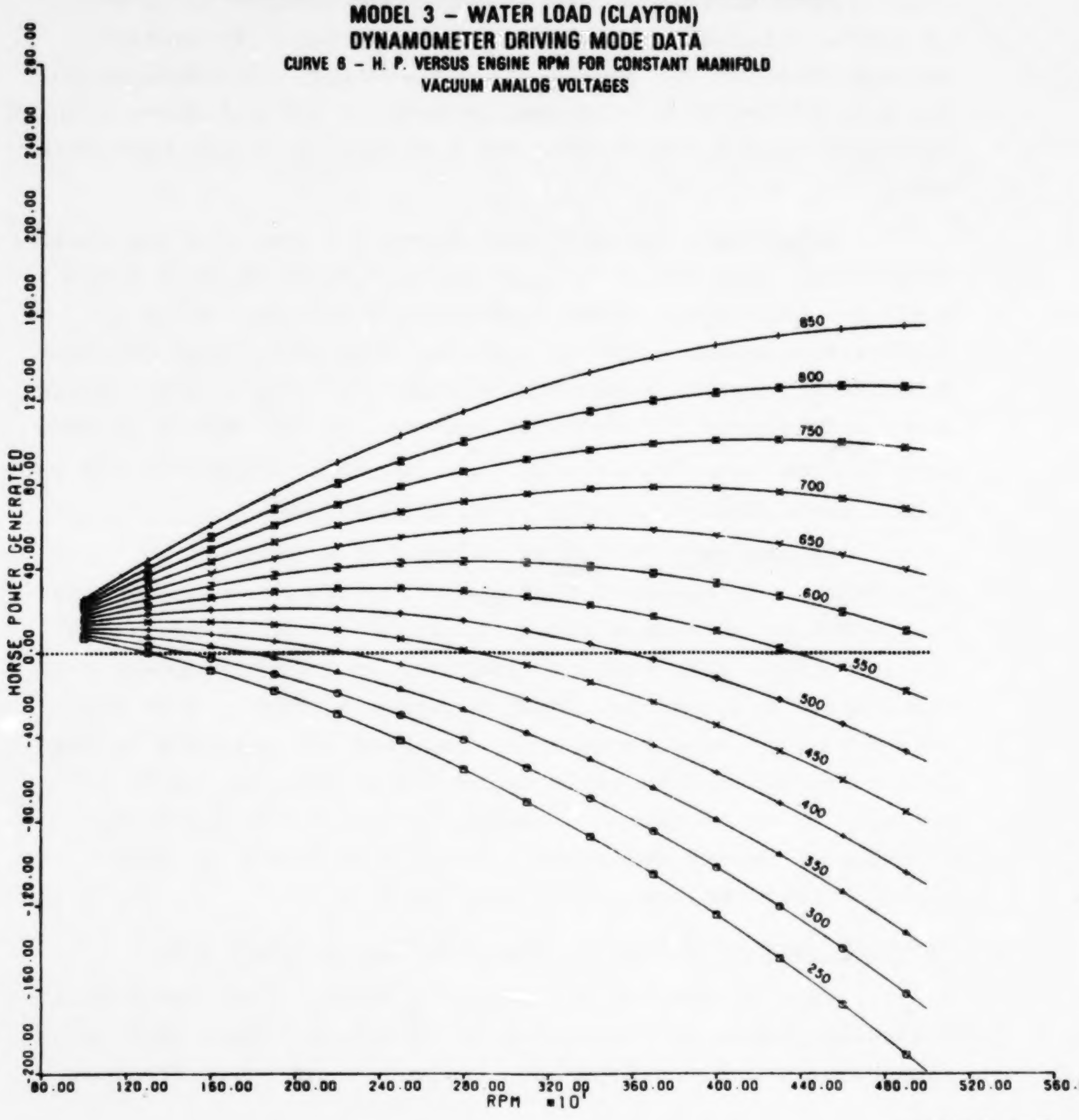


FIGURE D-7

Comparison Between Model 1 and 2 - The curves provide a simple means of comparing the model created using both driving and motoring calibration data and the model using a large number of points from the motoring mode -- both sets of inputs obtained on the electrodynamometer. It appears obvious that the two models are not similar, particularly in the area of low-load, slow engine speed. Serious distortion of horsepower would result if Model 1 were used to calibrate field data.

Comparison Between Model 2 and 3 - How well the field calibration procedure and type dynamometer to be used could replicate the "true" model created from a large number of calibration points taken on a large, laboratory-type electrodynamometer, can be demonstrated from this comparison. While some disagreement is evidenced between the two models -- particularly in the area of low load, low engine speed -- the two models were judged to be in acceptable agreement.

Truncated Combination of Model 2 with Motoring Only Model - It appeared that a model could be created using only motoring mode data to replicate that mode of engine operation which could then be truncated at zero horsepower with Model 2 for a composite, ideal horsepower model. This procedure was not done because the question was academic to the particular study. No field dynamometers were available to perform this calibration procedure in the field operations. Therefore, even if desirable results were found, it could not have been implemented in this survey.

Validity Test of Model 2 - Variable Significance Test

The validity of variables in Model 2 was tested by the following procedure, illustrative of the procedure used in all subsequent model development. A sequence of equations were generated from the electrodynamometer driving mode data. They are illustrated in Table D-1.

Equation 1 is the first solution obtained by allowing all variables to enter. Note that all variables are significant, in that the coefficients are all different from zero, as determined from the F-Value. This equation also gives the lowest standard error of estimate (i.e. how well the curve fits the data). If this were the only factor in judging the feasibility of the equation, the solution would be used. The equation contians 9 variables whereas equations 3, 4, and 5 contain only 4 and have approximately the same standard errors. A statistical test found that equations 1, 3, 4, and 5 were equivalent. Any one of these could be chosen as a valid horsepower model. Equation 4 was picked due to its simplicity. Note that equation 4 contains the variable (RPM^2), and in equation 5 (RPM^3) appears. All other variables are the same form with slightly different coefficents. The calculated statistics in the two equations are the same, indicating no difference between the two equations in predicting horsepower. The term of (RPM^3) adds nothing to the validity model for this specific truck engine.

Test of Validity of Models Developed from 9-Point Calibration Data

Since the first group of vehicles in the survey were calibrated from 9 data points, how valid would models developed from these data be if the regression analysis procedure was employed? An investigation of this question required not only data run at Ann Arbor, but also use was made of a number of other models of trucks on which dynamometer/load factor/engine speed data were available. Data on 4 models were available from a previous EPA study.*

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*Southwest Research Institute, Exhaust Emissions from Gasoline-powered Vehicles above 6000-lb. Gross Vehicle Weight prepared for EPA, April 1972, NTIS #PB-220 365.

Table D-1
Selected Portion of Complete
Multiple Regression Analysis-driving Mode

Entered Variables	F-Value	Std. Err. Est.	R^2
Equation 1			
1. HG	7.16		
2. RPM * HG	7.66		
3. RPM * HG^2	6.93		
4. RPM^2 * HG^2	5.56		
5. RPM^2 * HG^2	9.91		
6. RPM^2 * HG^4	11.58		
7. RPM^2 * HG^5	12.42		
8. RPM	352.81		
9. RPM^3	7.58	2.2855	99.67
Equation 2			
1. HG	1.60		
2. RPM * HG	159.69		
3. RPM	387169	5.2806	97.83
Equation 3			
1. HG^2	4.91		
2. RPM * HG	785.20		
3. RPM	723.79		
4. RPM^3	84.22	2.7534	99.43
Equation 4			
1. HG	7.22		
2. RPM * HG	625.68		
3. RPM^2	90.09		
4. RPM	405.47	2.6829	99.46

Table D-1(contd.)

Entered Variables	F-Value(1)	Std. Err. Est.	R^2
Equation 5			
1. HG	7.12		
2. RPM * HG	629.82		
3. RPM^3	91.23		
4. RPM	744.52	2.6702	99.47
Equation 6			
1. HG	4.12		
2. RPM * HG	445.32		
3. RPM^2	527.69		
4. RPM^3	286.55	3.1468	99.46

---

(1) The F-Value determines the significance of the variable in the Equation - In this case if F is larger than 4.0 variable is significant.

This proved data inputs to generate five 9-point horsepower models: One from the large number of calibration points available from driving mode runs on the electro-dynamometer on the EPA truck, one from 70 observed points on a 1969 Chevrolet 250 cubic inch displacement engine, one from 59 points on a 1969 300 cubic inch displacement engine, one from 66 points on a 1969 International Harvester 304 cubic inch displacement engine, and one from 68 points on a 1969 International Harvester 304 cubic inch displacement engine, and one from 68 points on a 1969 Dodge 318 cubic inch engine. "True" horsepower models from these data are shown in Table D-2.

The next step was to generate 3 horsepower models based on 9 data points from each of the 5 data sets on the 5 vehicles. In order to duplicate the original field calibration procedures, the observed data points for the above vehicles were stratified by RPM. For example, the 70 data points for the 250 CID engine were stratified by 3 RPM ranges, low, medium, and high. Next, 9 random numbers were generated, 3 for each stratification, with each random number corresponding to one of the 70 data points. This gives 3 data points in each stratification randomly duplicating the original field operations. A sample HP model was then developed for the 9 points and compared to the actual models as shown in Table D-3. The 9-point model generation was performed three times for the five vehicles, thus generating a total of 15 HP models.

The final step in the procedure was to generate HP values from each model for substantially the complete operating ranges of RPM and manifold vacuum. This was performed for each of the 20 models, and a comparison made of the predicted

Table D-2

"True" Horsepower Models

Engine 250 CID - 70 Data Points

$$HP = - 0.03809\ (HG)^2 - 6.79516\ (RPM)\ (HG) - 20.75420\ (RPM)^2\ (HG) + 369.95239\ (RPM) - 7.62244$$

Engine 300 CID - 59 Data Points

$$HP = 0.29159\ (HG) - 21.01509\ (RPM)\ (HG) + 492.46118\ (RPM) - 11.92026$$

Engine 304 CID - 66 Data Points

$$HP = - 1.12607\ (HG) - 3.70481\ (RPM)^2\ (HG)^2 + 373.90845\ (RPM) + 0.22626\ (RPM)^3\ (HG)^3 - 0.56951$$

Engine 318 CID - 68 Data Points

$$HP = 0.59851\ (HG) - 24.53311\ (RPM)\ (HG) - 563.64502\ (RPM)^2 + 722.61523\ (RPM) - 27.19754$$

Table D-3
Sample Horsepower Models

Engine 250 CID - 9 Data Points

(1) $HP = -0.06070\ (HG)^2 - 33.63466\ (RPM)^2\ (HG) + 365.11035\ (RPM) - 12.27338$

(2) $HP = -3.85254\ (HG) + 0.07887\ (HG)^2 - 26.82590\ (RPM)^2\ (HG) + 335.34741\ (RPM) + 12.96709$

(3) $HP = -1.24092\ (HG) - 328.88330\ (RPM)^2 - 38.62146\ (RPM)^2\ (HG) + 523.56665\ (RPM) - 22.05040$

Engine 300 CID - 9 Data Points

(1) $HP = -0.04827\ (HG)^2 - 8.21326\ (RPM)\ (HG) - 25.71581\ (RPM)^2\ (HG) + 471.41431\ (RPM) - 12.68788$

(2) $HP = 0.01644\ (HG)^2 - 20.82625\ (RPM)\ (HG) - 0.26095\ (RPM)^2\ (HG)^2 + 523.40527\ (RPM) - 15.32303$

(3) $HP = 0.02627\ (HG)^2 - 19.40298\ (RPM)\ (HG) - 0.00001\ (RPM)\ (HG)^5 + 461.78760\ (RPM) - 8.29637$

Engine 304 CID - 9 Data Points

(1) $HP = -0.08299\ (HG)^2 - 39.43434\ (RPM)^2\ (HG) + 272.35229\ (RPM) + 678.85767\ (RPM)^3 + 11.88305$

(2) $HP = -0.06369\ (HG)^2 - 14.31857\ (RPM)\ (HG) + 451.63013\ (RPM) - 494.45190\ (RPM)^3 - 1.10542$

(3) $HP = -1.66892\ (HG) + 597.63574\ (RPM)^2 - 53.91217\ (RPM)^2\ (HG) + 211.75844\ (RPM) + 19.24414$

Engine 318 CID - 9 Data Points

(1) $HP = 0.01459\ (HG)^2 - 22.47321\ (RPM)\ (HG)\ 634.48120\ RPM - 1278.21313\ (RPM)^3 - 20.11766$

(2) $HP = -1.94978\ (HG) + 1014.28662\ (RPM)^2 - 50.82550\ (RPM)^2\ HG + 46.21507$

(3) $HP = 0.63844\ (HG) - 25.61179\ (RPM)\ (HG) - 262.68872\ (RPM)^2 + 595.52539\ (RPM) - 12.56421$

Electo-Dyno Driving Mode - 9 Data Points

(1) $HP = 0.10606\ (HG)^2 - 3162105\ (RPM)\ (HG) + 504.74048\ (RPM) - 8.21309$

(2) $HP = -0.2599\ (HG)^2 + 0.00043\ (HG)^4 - 36.15044\ (RPM)^2\ (HG) + 327.58350\ (RPM) + 15.42221$

(3) $HP = -3.53904\ (HG) + 466.91626\ (RPM)^2 - 1.91580\ (RPM)^2\ (HG)^2 + 68.88266$

results. RPM was varied from 1000-4000 and manifold vacuum ranged from 23.32 to 0.18 inches of mercury. Table D-4 illustrates these predicted HP values for the models.

Table D-5 summarized the 9-point data test. The two columns that are most significant in determining the validity of 9 data points are the mean of the differences and the standard deviation of the differences. The mean of the difference is calculated by determining the HP for each increment of rpm and manifold vacuum for each increment of rpm and manifold vacuum for the expected horsepower model and each 9 point model. The difference was then calculated between the "expected" and "predicted" HPs. The differences were then summed and averaged. The standard deviation of these differences were calculated.

Evaluation of these numbers provided an estimation of the expected average error for 9-point horsepower models to models that would be generated with 30+ points. In most cases, the mean differences lie within 5 HP of the expected values. The electrodynamometer 9-point tests did not fall in the above limits, which is thought to be due to the fact that no 0 HP points were generated in the original calibration test and the randomly selected data points did not cover the entire range of engine operation.

It is important to note that during the original field calibration, data points were collected based on a stratification of two variables: RPM and Load factor. Whereas the 9-point data test merely stratified on RPM and let the load factor fall where the random number generator indicated. Therefore the field generated data points would give an even more accurate description of HP since a greater portion of the curves would be covered.

As a result of this 9-point data test, the calibration

Table D-4

Comparisons Between the "True" Model Horsepower and the Predicted Horsepowers of the Three 9-point Models

"True" Model HP-250	Predicted Horsepowers		
	HP-1	HP-2	HP-3
6.25	4.20	1.40	1.62
13.69	11.91	8.97	7.90
20.00	17.80	18.89	14.18
25.17	21.89	31.16	20.45
29.21	24.18	45.77	26.73
4.51	4.77	6.42	8.02
15.40	15.90	12.93	16.16
25.15	25.22	21.80	24.29
33.77	32.74	33.01	32.43
41.25	38.45	46.57	40.57
47.60	42.36	62.48	48.71
22.93	24.97	22.38	26.03
35.39	36.56	33.05	36.78
46.72	46.35	46.07	47.52
56.91	54.33	61.44	58.27
65.98	50.51	79.16	69.01
12.13	15.10	19.07	17.15
28.83	31.41	29.72	31.25
44.41	45.93	42.73	45.34
58.85	58.63	58.08	59.44
72.16	69.53	75.78	73.54
84.33	78.63	95.82	87.63
12.90	15.35	21.48	13.62
33.12	35.23	34.98	31.81
52.21	53.31	50.83	50.00
70.16	69.59	69.02	68.19
86.98	84.06	89.57	86.39
102.66	96.72	112.45	104.58
11.66	12.33	21.75	4.67
35.79	36.43	38.14	27.71

Table D-4

"True" Model	Predicted Horsepowers		
HP-300	HP-1	HP-2	HP-3
9.08	5.87	7.88	13.07
16.06	15.12	14.46	18.49
23.04	22.93	21.44	24.17
30.02	29.32	28.82	30.48
37.00	34.26	36.65	37.54
6.27	4.50	6.39	10.09
17.30	18.01	17.01	20.56
28.34	30.09	27.94	30.07
39.37	40.73	39.19	39.59
50.40	49.93	50.75	49.65
61.44	57.70	62.63	60.45
10.44	11.32	10.56	12.90
25.53	28.15	25.82	28.05
40.62	43.55	41.25	41.65
55.70	57.51	56.86	55.01
70.79	70.03	72.65	68.83
85.87	81.12	88.61	83.37
14.62	15.63	14.24	15.71
33.75	36.28	34.31	35.53
52.89	55.49	54.37	53.22
72.03	73.27	74.44	70.43
18.79	17.45	17.43	18.52
41.98	42.41	42.48	43.02
65.17	65.93	67.32	64.80
88.36	88.02	91.75	85.84
22.96	16.76	20.12	21.33
50.20	46.53	50.33	50.50
77.45	74.86	80.08	76.38
104.69	101.75	109.37	101.26

Table D-4

"True" Model HP-304	Predicted Horsepowers		
	HP-1	HP-2	HP-3
11.08	13.43	5.71	11.94
18.84	23.71	17.95	20.45
25.74	31.52	28.30	28.97
31.69	36.85	36.75	37.49
36.62	39.72	43.31	46.00
20.54	20.97	15.94	19.48
32.02	33.15	27.94	30.07
41.81	42.85	44.05	41.71
49.67	50.09	55.27	52.82
55.31	54.87	64.58	63.94
27.43	26.95	25.06	25.80
43.46	41.79	42.83	40.56
56.98	54.17	58.70	55.31
67.37	64.07	72.67	70.06
74.01	71.50	84.75	84.82
9.34	11.17	10.28	11.47
32.38	31.90	32.70	30.90
53.45	50.16	53.23	50.34
71.33	65.96	71.86	69.77
84.82	79.28	88.59	89.20
8.42	11.40	13.30	9.64
36.04	36.32	38.48	34.79
62.25	58.76	61.77	59.94
84.95	78.74	83.16	85.09
102.03	96.24	102.66	110.24
7.98	10.85	14.10	5.55
39.06	40.71	42.04	37.46
70.15	68.10	68.09	69.37
97.91	93.02	92.25	101.27

Table D-4 (Continued)

"True" Model HP-318	Predicted Horsepwers		
	HP-1	HP-2	HP-3
10.48	10.53	18.00	14.35
17.63	17.66	27.48	21.77
24.79	25.22	36.96	29.19
31.94	33.22	46.44	36.60
39.10	41.65	55.92	44.02
20.42	21.69	20.76	20.86
32.31	33.15	32.69	33.22
44.19	45.04	44.62	45.57
56.08	57.37	56.55	57.93
67.96	70.14	68.48	70.28
27.55	29.96	24.63	226.06
44.16	45.76	39.99	43.35
60.78	61.99	55.35	60.64
77.39	78.65	70.71	77.94
94.01	95.75	86.08	95.23
31.85	34.40	29.60	29.94
53.20	54.53	49.38	52.17
74.55	75.10	69.15	74.40
95.89	96.10	88.92	96.64
7.26	10.02	10.52	5.33
33.34	34.05	35.68	32.50
59.42	58.52	60.85	59.68
85.49	83.41	86.01	86.85
32.01	27.95	42.87	33.76
62.82	56.75	74.40	65.87
93.63	85.98	105.94	97.98

Table D-4 (contd.)

"True" Model HP-Electro	Predicted Horsepowers HP-1	HP-2	HP-3
9.18	18.74	4.74	13.65
16.29	19.75	16.24	29.33
23.41	23.91	30.80	44.43
30.52	31.23	42.60	58.96
37.64	41.70	48.11	72.92
16.75	19.31	14.06	13.66
28.77	26.41	27.31	31.86
40.78	36.67	43.62	48.77
52.80	50.08	57.16	64.40
64.82	66.65	64.41	78.75
21.35	19.87	20.57	13.66
38.27	33.07	36.26	35.40
55.19	49.43	55.00	54.85
72.11	68.94	70.98	72.03
89.03	91.61	80.67	86.92
22.97	20.43	24.25	13.67
44.79	39.73	43.80	39.95
66.61	62.19	64.96	62.67
88.43	87.80	84.08	81.83
110.25	116.56	96.91	97.43
21.61	20.99	25.12	13.68
48.33	46.39	47.78	45.52
75.06	74.95	73.50	72.23
17.28	21.56	23.16	13.69
48.90	53.05	50.36	52.10
80.53	87.70	80.60	83.53
9.97	22.12	18.39	13.70
46.50	59.71	50.81	59.69
83.02	110.46	86.28	95.56

Table D-5

9 POINT DATA TEST

Test	Model	Data Points	Mean Horsepower	Mean of the Differences	Standard Deviation of The Differences
1	HP-250	70	39.70	--	--
	HP-1	9	38.36	1.34	2.70
	HP-2	9	44.27	-4.57	6.92
	HP-3	9	37.52	2.18	6.62
2	HP-300	59	52.89	--	--
	HP-1	9	49.60	3.29	4.65
	HP-2	9	53.87	-0.97	3.47
	HP-3	9	51.46	1.43	3.95
3	HP-304	66	46.08	--	--
	HP-1	9	45.68	0.39	4.20
	HP-2	9	45.72	0.34	6.28
	HP-3	9	49.97	3.90	11.02
4	HP-318	68	47.56	--	--
	HP-1	9	45.81	1.75	6.32
	HP-2	9	53.55	-5.99	10.89
	HP-3	9	49.54	-1.98	3.47
5	HP-ELECTRO	52	38.84	--	--
	HP-1	9	46.04	-7.27	9.77
	HP-2	9	47.22	-8.39	18.84
	HP-3	9	33.71	5.12	15.50

procedure applied to trucks 2-20 and buses 80-83 generated enough data so an acceptable HP Model could be developed.

The conclusions drawn from these investigations were:

- Horsepower equation form was not necessarily quadratic - a better fit could be obtained through a multiple regression analysis procedure allowing any powers or products of independent variables which were significant.
- Although models created by 9-point calibration could be acceptable, using the new procedure better correlation was obtainable with a larger number--say 30 points (6 horsepower loads at 5 constant engine speeds.)
- Models created from driving mode calibrations could not represent motoring mode loads--two distinctly different models were generated under + and - horsepower calibrations, and trucation of the two at zero horsepower was required to develop a complete model.
- Calibrations performed on a water load dynamometer replicate driving mode conditions of electrodynamometer loads to an acceptable confidence level.

Horsepower Models for Survey Trucks

Field calibration data for each of the survey trucks were employed in the revised methodology to generate horsepower models. Two steps were included in this procedure.

One involved the generation of a load factor model which converted the sensor output voltage, x, to appropriate engineering terms. For gasoline engines, x was converted to manifold vacuum in inches of Hg. Load factor measurements for those diesels in which the sensor measured rail pressure, x was converted to pounds per square inch. For diesels where rack linear displacement was monitored, no conversion was made, and the load factor, L was equal to x.

The second step was to generate an acceptable horsepower

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Table D-6

LOAD FACTOR AND HORSEPOWER MODEL SUMMARY

Truck Number	Load Factor Model M= Manifold Vacuum (HG) *R= Rail Pressure P= Rack Position X= Channel 4 Voltage	L = Load Factor (in Inches HG; or Rail pressure or rack position voltage) E = Engine Speed (RPM)	No. of Cal. Points	σ	R^2
		Not Assigned	-	-	-
1	M= -37.11266 (x) + 30.76349	$-.70912(L) - .11904(L)^2 - 27.6344(E)^2(L) + 163.71953(E) + 15.25119$	11	.89	99.92
2	M= -33.65996 (x) + 29.72824	$-15.[illegible]3942(E)(L) + 283.53613(E) + 5.15494$	10	4.74	98.67
3	M= -35.85419 (x) + 31.72565	$-3.46717(L) + .06838(L)^2 - 26.95181(E)^2(L) + 228.86046(E) + 21.12505$	10	3.01	99.56
4	M= -36.85045 (x) + 30.53741	$-105161(L)^2 + 1125.54321(E)^2 - 214.28693(E)^3(L) + 2.67747(E)^3(L)^2 + 5.71136$	9	1.67	99.87
5	M= -33.45145 (x) + 30.15271	$-1.84043(L) - 24.60982(E)^2(L) + 194.38348(E) + 14.20471$	10	5.34	97.63
6	M= 34.21846 (x) + 29.94461	$1.39651(L) - 34.43105(E)(L) + 610.19995(E) - 13.85268$	10	4.62	99.62
7	M= 32.98082 (x) + 29.55466	$-19.62361(E)(L) + 644.51147(E) - 1674.69897(E)^3 - 27.07355$	10	4.79	98.65
8	M= 34.43048 (x) + 30.83118	$-2.05627(L) - 88.82094(E)^2(L) + 2.55963(E)^2(L)^2 + 327.07129(E) + 9.08679$	10	3.90	99.35
9	P= 1.00000 (x)	$1064.63989(L) - 1684.01025(L)^2 + 3877.13452(L)^3(E) - 77.15215$	10	3.90	99.57
10	M= -33.29298 (x) + 30.38422	$-26.96132(E)(L) + .52334(E)(L)^2 + 2005.9502(E)^2 - 3831.5(E)^3 + 13.87106$	10	1.57	99.91
12	M= -33.86835 (x) + 30.39763	$-4.65231(L) + .11792(L)^2 - 33.99907(E)^2(L) + 251.38724(E) + 23.0978$	10	3.23	99.59
13	M= -33.79219 (x) + 29.93893	Model Derived was not accepted	-	-	-
14		Not Assigned			
15	M= -35.65921 (x) + 30.95053	Data Not accepted			
16	P= 1.00000 (x)	$626.37524(E)(L)^2 - 1779.34155(E)^3(L)^2 - 10.54032$	10	3.47	99.04
17	M= -33.35796 (x) + 30.37299	$-24.81006(E)(L) + 1.94369(E)^2(L)^2 + 417.74170(E) - 1459.64429(E)^3 - 4.80102$	10	4.58	98.20
18		Not Assigned			
19		Not Assigned			
20	M= -36.27423 (x) + 30.73193	$-6.93130(L) + .28943(L)^2 - 9.52345(E)(L) + 186.60231(E) + 18.83562$	10	5.53	93.58
21		Data Not Accepted			
22		Not Assigned			
23		Not Assigned			
24		Not Assigned			
25		$-27.9187(E)(L) - 586.3894(E)^2 + 642.19678(E) - 12.38226$	30	3.61	98.91
26	M= -34.97665 (x) + 31.58215	Model Derived Was Not Acceptable	-	-	-
27	R= 340.11475 (x) + 13.72424	$27.52293(E)(L) - .05553(E)(L)^3 + 8116.69922(E)^2 - 39018.55078(E)^3 + 78.88254$	26	5.41	98.60
28	M= -34.42830 (x) + 31.31189	$-7.73532(L) + .30579(L)^2 + 350.42847(E) - 923.6636(E)^2 - 199.9737(E)^3(L) + 10.194$	33	5.18	95.59
29	M= -34.56802 (x) + 31.50005	$-1.34054(L) - 269.12158(E)^2(L) + 27.15665(E)^2(L)^2 - .92299(E)^2(L)^3 + 380.2263(E) - 2.37157$	36	2.66	99.06
30	M= -34.20691 (x) + 31.09253	$-2.54953(L) - 120.5116(E)^2(L) + 547.86108(E) + 8.0593$	30	3.13	98.94
31	M= -36.05095 (x) + 31.77003	$-4.01273(L) + .10956(L)^2 - 55.34984(E)^2(L) + 242.5451(E) + 14.16556$	28	2.22	98.84
32	R= 327.75491 (x) + 9.77350	$-3.68657(L) + .60095(E)(L)^2 + 1133.79077(E)^2 - 95.4437(E)^2(L) + 54.15414$	30	2.53	99.34
33	M= -34.78876 (x) + 31.14711	$-2.05481(L) - 517.52734(E)^2 - 2.94962(E)^2(L)^2 + 406.34766(E) + .11803$	30	2.97	98.39
34	R= 333.91740 (x) + 13.61860	$28.84428(L) - .04334(L)^3 - 98.84196(L)(E) + 5.33105(E)^3(L)^3 - 7.38953$	26	4.31	98.10
35	M= -35.05995 (x) + 31.09770	Model Derived Was Not Acceptable	-	-	-
36	R= 348.65040 (x) + 9.02280	$20.82198(L) - 1.82519(L)^2 + 94.73334(E)(L) - 2679.979(E)^2 + 3.24152$	30	3.21	96.59
37	R= 384.25700 (x) - 2.13960	$102.64738(E)(L) - 20.62505(E)^2(L)^2 - 3394.61621(E)^3 + 20.90292$	28	4.39	93.05
38	M= -34.95789 (x) + 31.21252	$-1.61528(L) - 116.99608(E)^2(L) + 392.72582(E) + 9.60109(E)^3(L)^2 - 2.62664$	30	3.12	98.38
39	M= -33.20634 (x) + 31.12112	$-.87036(E)(L)^2 + 192.19353(E) + 13.51393$	24	2.77	96.72
40		Not Assigned			
41		Not Assigned			
42	P= 1.0000 (x)	Model Derived Was Not Acceptable	-	-	-
43	R= 235.45910 (x) + 30.88330	Model Needs Zero HP Data Points	-	-	-
44	M= -35.82504 (x) + 31.57407	$-1.89085(L) - 946.24634(E)^2 - 1.87816(E)^2(L)^2 + 563.67749(E) - 19.33261$	32	2.36	98.72
45	M= -35.07979 (x) + 31.57417	$-31.33009(E)(L) + 3603.71973(E)^3 + 70.18793$	34	4.37	97.73
46		Data Not Accepted			
47	R= 335.59420 (x) + 11.67310	$-43.8056(L) - 4.27959(L)^2 + 19.85115(E)(L)^2 - 613.52979(E)^2(L) - 24.90085$	32	4.66	99.29
48	M= -35.07979 (x) + 31.27312	Model Derived Was Not Acceptable	-	-	-
49	M= -34.63213 (x) + 31.72081	$-2.56398(L) + 234.01685(E) - 252.97844(E)^2(L) + 10.79330(E)^3(L)^2 + 8.35427$	39	6.50	94.92
50	M= -33.84221 (x) + 31.31294	$-3.03911(L) - 76.44043(E)^2(L) + 1.82354(E)^2(L)^2 + 310.86011(E) + 29.13473$	39	4.99	97.44
51	M= 34.15230 (x) + 31.27312	$2.44413(L) - 40.35834(E)(L) + 2.09964(E)^2(L)^2 + 402.21118(E) - 3.79414$	27	2.99	98.87
52	M= 37.381711 (x) + 32.05488	$-6.13165(E) + .15547(E)^2 - 15.26339(E) + 95.95163(E)^2(L) + 54.88933$	37	4.07	89.50
53	M= -33.33952 (x) + 30.37033	$15.25521(L) - 2.95499(E)(L)^2 - 1536.13916(E)^3 + 1.58271(E)^3(L)^3 - 5.68650$	34	3.49	99.45
54	R= 351.23120 (x) + 10.31570	$24.98303(L) + .87790(L)^2 - .02401(L)^3 - 132.21260(E)(L) - 9.30766$	31	5.97	98.08
55	P= 1.00000 (x)	Model Needs Zero HP Data Points	-	-	-
56	P= 1.00000 (x)	$23667.73047(L) - 17080.1210(L)^2 + 11106.72266(E)(L)^2 - 9240.629(E)^2 - 8331.57$	34	4.62	99.50
57	R= 346.646650 (x) + 10.29100	$6.89497(L) - .95835(L)^2 + 177.47729(E)(L) - 34278.57422(E)^3 + 34.74164$	24	3.40	99.47
58	R= 344.66780 (x) + 11.37530	$38.05254(L) - 97.53494(E)(L) - 205.45979(E) + 3.34004$	23	6.49	99.59
59	M= -34.40755 (x) + 30.42195	$-10.57573(L) - 2014.0918(E)^2 + 1042.91187(E) - 42.35168$	32	4.83	96.01
60	R= 407.10070 (x) + 1.61800	$29.53(L) - 2.20(L)^2 + .18(E)(L)^3 + 67.22(E)^2(L)^2 - 8402.92(E)^3 - 261.59(E)^3(L)^2 + 9.1$	36	5.45	99.17
61	M= -33.45899 (x) + 30.68411	$-30.28737(E)(L) + 8152.40234(E)^2 - 2369.17627(E) + 249.09167$	32	4.84	97.14
62	R= 328.28400 (x) + 10.10490	$18.71239(L) - 254.21294(E)^2(L) - 11.74881$	20	3.57	97.61
63		Not Assigned			
64	M= -35.27802 (x) + 31.25227	$-3.53729(L) - 87.41228(E)^2(L) + 621.43188(E) + 17.61893$	32	4.27	99.35
65	R= 348.67510 (x) + 9.65970	$16.30679(L) - 1.42973(E)(L)^2 - 843.90112(E)^2 - 5.35431$	31	6.71	97.13
70	M= -33.84221 (x) + 31.31294	Same as Truck 50			
Bus					
80	P= 1.0000 (x)	$-212.26344(L)^2 - 10856.12109(E)^2(L)^2 + 844.8064(E) + 83.51875$	10	2.59	99.71
81	P= 1.0000 (x)	$2950.20654(E)(L) - 6516.44141(E)^3 - 22.57326$	10	2.94	99.74
82	P= 1.0000 (x)	$-6129.25(E)(L) + 3375.94531(E) + 56.35547$	10	6.69	98.02
83	P= 1.0000 (x)	$-92.36125(L) + 2.56059(L)^2 + 1.19095(E)^2(L)^2 - 1557.12329(E)^2 + 808.47705$	10	4.09	99.24

*Rail pressure models should be factored down by 10 before using in the HP model.

model, in terms of the appropriate load factor dimension. This employed the multiple step-wise regression program of the revised horsepower model procedure. The two independent variables, load factor (L) and engine rpm (E) were permitted to be introduced to 5th power, either singlarly or in products of the two variables. Tests of standard error of estimate (O), and correlation squares, and significance test (F) were performed and examined to determine the acceptability of the model. Generally, F-test results had to be greater than 4.0 for a term to remain in the equation, standard error of estimate low and high correlation.

Table D-6 indicates the load factor and horsepower models created for each survey truck. Models derived were not acceptable as a result of failure of these tests or insufficient calibration data for trucks 13, 26, 35, 42, 43, and 55, but raw data appeared acceptable as result of Z pattern tests and other data control criteria are included in the survey data file.

Appendix E

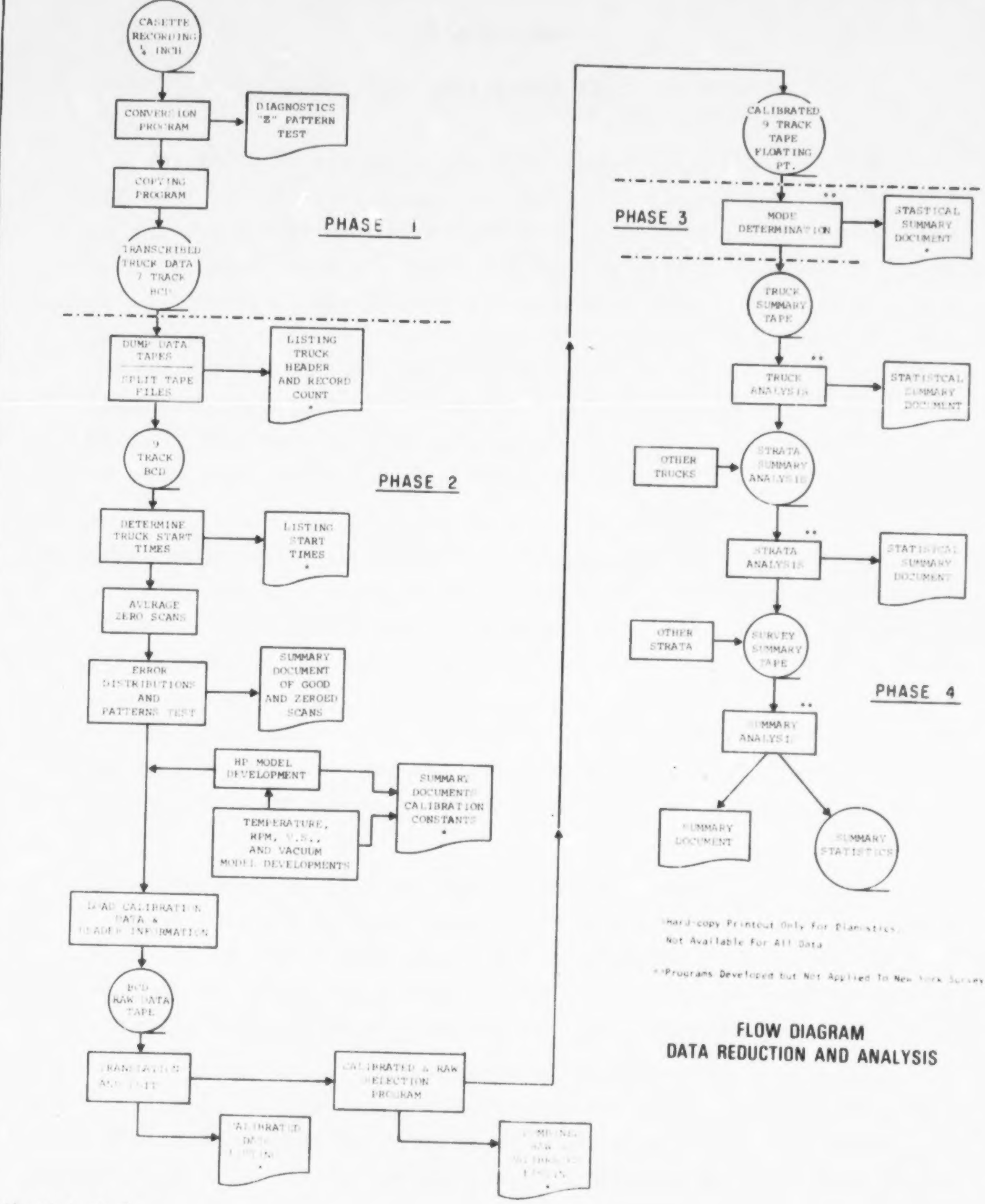
PLANNED DATA PROCESSING AND ANALYSIS

The original data processing and analysis planned for the survey is shown in the flow diagram, Figure E-1. This flow begins with the cassette of raw data taken in the field and ends with the summary statistics of the survey trucks defining their pattern and use. Note that the field data was processed as shown down through the BCD RAW DATA TAPE stage. Further, the survey processing proceeded as shown to the CALIBRATED 9 TRACK TAPE/ FLOATING PT. stage except that Channel 4 (horsepower) was left in raw sensor data form and horsepower models were not applied. To continue with the processing as planned, these data must be converted to horsepower.

Mode Determination Program - In order to completely evaluate truck characteristics, it would be necessary to accumulate the calibrated truck data in a manageable and useful form. The mode determination program is the basic tool for analyzing this calibrated data, and describing truck behavior in mode terms of accelerations, decelerations, cruises, etc. Tests were made of such a program initially generated, but which were not refined to an acceptable level due to changes in contractual responsibilities.

Figure E-1 charts the logic flow of mode determination program. This logic was based on various selection rules found in Table E-1. The parameters specified were based on gas trucks as outlined in Table E-2. Diesel truck logic would be identical to that of gas trucks, only the parameters may differ slightly.

The output of the mode determination program would be expressed in such a way as to allow both visual and mechanical evaluation of truck behavior. To accomplish this efficiently truck behavior, as specified by the above logic would be described


CASETTE RECORDING ¼ INCH
CONVERSION PROGRAM
DIAGNOSTICS "Z" PATTERN TEST
COPYING PROGRAM
PHASE 1
TRANSCRIBED TRUCK DATA 7 TRACK BCD
DUMP DATA TAPES
SPLIT TAPE FILES
LISTING TRUCK HEADER AND RECORD COUNT *
9 TRACK BCD
PHASE 2
DETERMINE TRUCK START TIMES
LISTING START TIMES *
AVERAGE ZERO SCANS
ERROR DISTRIBUTIONS AND PATTERNS TEST
SUMMARY DOCUMENT OF GOOD AND ZEROED SCANS
HP MODEL DEVELOPMENT
TEMPERATURE, RPM, V.S., AND VACUUM MODEL DEVELOPMENTS
SUMMARY DOCUMENTS CALIBRATION CONSTANTS *
READ CALIBRATION DATA & HEADER INFORMATION
BCD RAW DATA TAPE
TRANSLATION AND EDIT
CALIBRATED DATA LISTING *
CALIBRATED & RAW SELECTION PROGRAM
COMBINED RAW & CALIBRATED LISTING *
CALIBRATED 9 TRACK TAPE FLOATING PT.
PHASE 3
MODE DETERMINATION **
STASTICAL SUMMARY DOCUMENT *
TRUCK SUMMARY TAPE
TRUCK ANALYSIS **
STATISTCAL SUMMARY DOCUMENT
OTHER TRUCKS
STRATA SUMMARY ANALYSIS
STRATA ANALYSIS **
STATISTICAL SUMMARY DOCUMENT
OTHER STRATA
SURVEY SUMMARY TAPE
PHASE 4
SUMMARY ANALYSIS **
SUMMARY DOCUMENT
SUMMARY STATISTICS

*Hard-copy Printout Only For Diagnostics, Not Available For All Data

**Programs Developed but Not Applied To New York Survey Data

FLOW DIAGRAM
DATA REDUCTION AND ANALYSIS

Wilbur Smith and Associates

FIGURE E 1

Table E-1

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TYPICAL MODE SELECTION LOGIC RULES

1. Unsmoothed calibrated data is used to show exact changes in truck operation.
2. Gears are determined by the ratio of RPM to vehicle speed. The distinct ranges of variation in this ratio correspond directly to the actual number of truck gears: i.e., for a 3 geared truck, the following significant ratios apply:

Ratio	Gear
< 10 or >10,000	None
175-10,000	1
75-175	2
10-75	3

3. A change of mode is not allowed for only one record (0.88 seconds). This takes care of some fluctuations that occurred in the original raw data.
4. If all limits fail for a given record, the record is placed in the previous mode. This will give more realistic picture of the truck behavior since premature mode changes cannot take place.
5. Acceleration and deceleration intensities are calculated by dividing the rate of change of vehicle speed by 0.2 as the base change of speed for acceleration or deceleration.
6. Zero records or records that contained less than the required data were counted and used in the determination of the rate of change in speed for acceleration and deceleration.
7. Each record represented 0.88 of a second which was multiplied times the number of records in mode to give time in mode.
8. The 0.176 acceleration and deceleration change per record is based on a 0.2 mph change per second.
9. For acceleration and deceleration the trends in the data must last for "N" scans.* "N" scans are held in memory. An acceleration or a deceleration is not allowed unless the average vehicle speed is greater than or equal to 0.176 for these "N" scans.

*N scans is a smoothing constant to prevent mode decisions to be made on a single pair of consecutive scans, and to prevent severe oscillations in their indications. N is nominally 5, but can be varied to fit the circumstance.

in tabular and matrix form. This type of output could be transferred directly to paper and magnetic tape, for full evaluation of operational characteristics.

A test of the experimental mode-change program was run. The results of this run are shown in Table E-3. Because of reduction in contractual responsibilities, the program was not refined to correct ambiguities appearing therein. This program was not employed in further analysis of data. The table shows data divided into the following:

- Selected mode or submode.
- Start and finish time of mode.
- Initial speed.
- Final speed.
- Change of speed.
- Rate of charge.
- Intensity of rate of change based on 0.2 mph per second.
- Total time in mode.
- Sum of Horsepower for acceleration and cruise mode.

Figure E-2 indicates a sample plot of recorded data versus mode decision as shown in Table E-3.

In order to summarize truck patterns for a complete day, Table E-4 is prepared by the program. This summary includes the following for all modes and submodes:

- Mode frequency - describes the total number of times the truck went from mode (i) and to mode (j) in one day.
- Mean time in mode - describes the mean time in each mode. (hours: minutes: seconds).
- Variance - describes the variation in the mean time in each mode. (seconds squared).
- Deviation - describes the standard deviations of the mean time in mode. Equal to the square root of the variance (hours: minutes: seconds).
- Transition probability - describes the probability given a change of mode, (i) will go to mode (j).

Tables E-5 and E-6 are final summaries and contain additional information not yet outlined. This summary contains 11 matrices and summaries which are as follows:

- Mode frequency matrix.
- Mean time in mode matrix.
- Variance matrix.
- Transition probability matrix.
- Cruise mode matrix.
- Acceleration and deceleration intensity matrix.
- Horsepower summation matrix.
- Estimation distance traveled matrix.
- Traffic condition matrix.
- Summation of the total time the valve is closed during deceleration.
- Summation of total time vehicles is in idle, stop, hot-soak, or other modes.

The first four matrices combine the submodes of the previous table. The fifth matrix outlines the cruise mode in 5 mph increments and the sixth deals with intensities calculated by dividing the rate of change of vehicle speed by 0.2 mph per second. The seventh matrix sums horsepower for acceleration and cruise submodes. The eighth and ninth matrices would be used as an estimate of total miles traveled and under what conditions. The tenth and eleventh summations estimate times in modes. These tabulations and statistical summaries completely describe the sampled truck's behavior for that day of operation.

The daily summary for that truck would first be combined with other daily summaries for the same truck and analyzed for variance in trip patterns, for example, examining the variance in trip distance, vehicle speed, mode profile, number of daily trips and other parameters. Similar statistical examinations might be made by combining all trucks of a similar type, using similar fuel, and where sample plan permits, similar base locations. The statistical approach would be to locate both similarities and differences between trucks in the same strata and between different strata.

Table E-2

MODE SELECTION PARAMETERS - GAS TRUCKS

MODE	PARAMETERS	
Hot-Soak	Vehicle Speed	= 0 ± .1 mph.
	RPM	= 0 ± 50 rpm.
	Engine Temp.	> Ambient +50°
Stop	Vehicle Speed	= 0 ± .1 mph.
	RPM	= 0 ± 50 rpm.
	Engine Temp.	< Ambient + 50°
Idle	Vehicle Speed	= 0 ± .1
	RPM	> 100 rpm.
Acceleration	Change in Vehicle Speed	≥ + 0.176 for N Scans
	RPM	> 100
Acceleration Through Gears	Vehicle Speed	≥ + 0.176 for N Scans
	RPM	> 100
	Gear Change	
Cruise	Change in Vehicle Speed	< ± 2.5 Initial record
	HP	>2.0
	RPM	>100
Decelerate With Power	Change in Vehicle Speed.	≤ - .176 for N Scans.
	Throttle Valve Reading*	= 1
	RPM	> 100
Decelerate with Dynamic Braking	Change in Vehicle Speed	< - .176
	HP	< 2.0
	RPM	> 100
Decelerate	Change in Vehicle Speed	< - .176 for N Scans
	RPM	> 100
	Throttle-Valve Reading*	= 0
Coast	Vehicle Speed	< Last Scan V.S.
	Vehicle Speed	≠ 0 ± .1

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*Does not apply to diesel trucks.

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Table E-3

SAMPLE OF TYPICAL MODE CHANGE LISTING

```
TRUCK=21  DAY=  CITY=N.Y.  TYPE TRUCK=1  FUEL TYPE=GAS    WEIGHT=15  LICENSE=NY6621HB  INDUSTRY=
ENGINE MODEL=GMC6500V6  SERIAL NUMBER=                    DAYS SAMPLED=5

START  FINISH   MODE                  INITIAL  PEAK   CHANGE  RATE OF              TIME IN   SUM OF
                                      SPEED    SPEED  SPEED   CHANGE   INTENSITY   MODE      HORSEPOWER
08.20  08.20   01.00-IDLE                .0      .0      .0                        00.00.10                   00011  00000
08.20  08.20   06.01-ACC-GEAR           1.7     3.6     1.9     1.0       5.0      00.00.02      6.59         00002  00011
08.20  08.20   06.02-ACC-GEAR           7.7     7.7      .0      .0        .0      00.00.02      4.64         00002  00013
08.20  08.20   06.02-ACC-GEAR           6.6     9.0      .4      .1        .5      00.00.03      5.13         00003  00015
08.20  08.20   06.03-ACC-GEAR           9.2    13.0     3.8      .6       3.0      00.00.06     83.45         00007  00018
08.20  08.20   06.04-ACC-GEAR          17.0    19.6     2.6      .7       3.5      00.00.04      7.97         00005  00025
08.20  08.20   07.00-DEC-DYNAMIC       19.3      .0   -19.3    -1.4      -7.0      00.00.14                   00016  00030
08.20  08.21   01.00-IDLE                .0      .0      .0                        00.00.20                   00023  00046
08.21  08.21   05.02-ACCELERATION       8.3    11.2     2.9      .3       1.5      00.00.09     17.09         00010  00069
08.21  08.21   07.00-DEC-DYNAMIC        5.6     1.5    -4.1    -1.0      -5.0      00.00.04                   00005  00079
08.21  08.21   01.00-IDLE                .0      .0      .0                        00.00.10                   00011  00084
08.21  08.21   06.02-ACC-GEAR           8.1    10.8     2.7      .7       3.5      00.00.04      7.51         00005  00095
08.21  08.21   06.03-ACC-GEAR           9.1    14.4     5.3      .4       2.0      00.00.14    132.03         00016  00100
08.21  08.21   04.04-CRUISE            14.8    11.6    -3.2     -.3                00.00.10       .00         00011  00116
08.21  08.21   07.00-DEC-DYNAMIC        9.4     7.8    -1.6     -.4      -2.0      00.00.04                   00004  00127
08.21  08.21   04.03-CRUISE             8.9    11.2     2.3     1.2                00.00.02       .00         00002  00131
08.21  08.22   07.00-DEC-DYNAMIC        6.6      .0    -6.6    -2.2     -11.0      00.00.03                   00003  00133
08.22  08.22   01.00-IDLE                .0      .0      .0                        00.00.04                   00005  00136
08.22  08.22   04.02-CRUISE             4.1     4.2      .1      .1                00.00.02       .00         00002  00141
08.22  08.22   01.00-IDLE                .0      .0      .0                        00.00.37                   00042  00143
08.22  08.22   05.01-ACCELERATION        .8     8.8     8.0     2.0      10.0      00.00.04     42.27         00005  00185
08.22  08.22   07.00-DEC-DYNAMIC        7.8     7.7     -.1      .0        .0      00.00.03                   00003  00190
08.22  08.22   06.02-ACC-GEAR          10.4    15.9     5.5      .6       3.0      00.00.10     64.38         00011  00193
08.22  08.23   06.03-ACC-GEAR          19.3    21.9     2.6      .1        .5      00.00.20    275.59         00023  00204
08.23  08.23   06.05-ACC-GEAR          26.0    26.0      .0      .0        .0      00.00.03       .00         00003  00227
08.23  08.23   04.05-CRUISE            22.6    17.6    -5.0     -.7                00.00.07     70.11         00008  00230
08.23  08.23   05.05-ACCELERATION      21.8    23.2     1.4      .5       2.5      00.00.03     45.06         00003  00238
08.23  08.23   04.05-CRUISE            20.2    25.7     5.5     1.4                00.00.04    111.75         00005  00241
08.23  08.23   10.03-COAST             22.9    21.9    -1.0     -.5                00.00.02                   00002  00246
08.23  08.23   04.06-CRUISE            24.7    24.9      .2      .1                00.00.02      4.68         00002  00248
08.23  08.23   04.05-CRUISE            22.8    22.9      .1      .0                00.00.04    104.99         00005  00250
08.23  08.23   04.06-CRUISE            24.0    26.9     2.9      .3                00.00.10     91.13         00011  00255
08.23  08.24   07.00-DEC-DYNAMIC       25.2     3.9   -21.3    -1.5      -7.5      00.00.14                   00016  00266
08.24  08.24   10.01-COAST              3.8     1.0    -2.8     -.6                00.00.05                   00006  00282
08.24  08.24   01.00-IDLE                .0      .0      .0                        00.00.19                   00022  00288
08.24  08.24   06.01-ACC-GEAR           2.4    11.7     9.3      .9       4.5      00.00.10     19.07         00011  00310
08.24  08.24   06.03-ACC-GEAR          15.4    16.0      .6      .2       1.0      00.00.03      5.17         00003  00321
08.24  08.24   07.00-DEC-DYNAMIC       11.2     6.7    -4.5    -1.1      -5.5      00.00.04                   00005  00324
08.24  08.24   05.02-ACCELERATION       4.9    17.1    12.2     1.4       7.0      00.00.09    201.85         00010  00329
08.24  08.24   04.05-CRUISE            21.0    19.6    -1.4     -.5                00.00.03     48.71         00003  00339
08.24  08.25   05.03-ACCELERATION      20.2    21.7     1.5      .5       2.5      00.00.03       .00         00003  00342
08.25  08.25   07.00-DEC-DYNAMIC       17.1    13.1    -4.0    -1.0      -5.0      00.00.04                   00004  00345
08.25  08.25   08.00-DEC-POWER          9.8     9.0     -.8     -.3      -1.5      00.00.03                   00003  00349
08.25  08.25   04.03-CRUISE             9.5    10.4      .5      .1                00.00.07     31.34  ZERO  00008  00352
08.25  08.25   07.00-DEC-DYNAMIC        6.2     4.4    -1.8     -.9      -4.5      00.00.02                   00002  00360
08.25  08.25   10.01-COAST              4.3      .8    -3.5    -1.2                00.00.03                   00003  00362
08.25  08.25   01.00-IDLE                .0      .0      .0                        00.00.03                   00003  00365
08.25  08.25   06.01-ACC-GEAR           2.1     8.9     6.8      .8       4.0      00.00.09    138.07         00010  00368
08.25  08.25   06.02-ACC-GEAR          12.5    16.6     4.1     1.4       7.0      00.00.03     30.53         00003  00378
08.25  08.25   04.04-CRUISE            14.8    16.7     1.9      .6                00.00.03     54.25         00003  00381
08.25  08.25   04.05-CRUISE            22.1    21.8     -.3      .0                00.00.07    109.13         00008  00384
```

Table E-3 (Cont'd.)

SAMPLE OF TYPICAL MODE CHANGE LISTING

```
TRUCK=    DAY=3    CITY=N.Y.   TYPE TRUCK=    FUEL TYPE=GAS      WEIGHT=0F   LICENSE=NYA623FH   INDUSTRY=
ENGINE MODEL=CH.6-CCVE     SERIAL NUMBER=                        DAYS SAMPLED=5

                                    INITIAL   PEAK   CHANGE   RATE OF                 TIME IN    SUM OF
START  FINISH     MODE               SPEED    SPEED   SPEED    CHANGE    INTENSITY    MODE      HORSEPOWER

08.26  08.26  05.04-ACCELERATION      26.8     33.7     6.9       .3        1.5      00.00.26   [illegible]           00030  00392
08.26  08.26  10.02-COAST             29.4     24.1    -5.3      -.9                 00.00.06                         00007  00422
08.26  08.26  05.04-ACCELERATION      30.2     30.6      .4       .1         .5      00.00.04     61.97               00004  00429
08.26  08.26  07.00-DEC-DYNAMIC       29.7     23.8    -5.9     -3.0      -15.0      00.00.02                         00002  00433
08.26  08.26  04.06-CRUISE            24.2     26.4     2.2      1.1                 00.00.02       .00               00002  00435
08.26  08.26  07.00-DEC-DYNAMIC       24.4     22.5    -1.9      -.5       -2.5      00.00.04                         00004  00437
08.26  08.26  05.04-ACCELERATION      25.4     32.3     6.9       .4        2.0      00.00.18     76.54               00020  00441
08.26  08.26  04.06-CRUISE            26.5     23.2    -3.3      -.5                 00.00.07     25.68               00008  00461
08.26  08.27  07.00-DEC-DYNAMIC       18.8      1.5   -17.3     -1.6       -8.0      00.00.11                         00013  00469
08.27  08.27  01.00-IDLE                .0       .0      .0                          00.00.09                         00010  00482
08.27  08.27  04.02-CRUISE             3.9     11.5     7.6      1.5                 00.00.05     66.15               00006  00492
08.27  08.27  06.03-ACC-GEAR          14.9     18.0     3.1       .3        1.5      00.00.09     49.67               00010  00498
08.27  08.27  06.03-ACC-GEAR          21.6     21.6      .0       .0         .0      00.00.02       .00               00002  00508
08.27  08.27  06.04-ACC-GEAR          21.9     22.6      .7       .2        1.0      00.00.03     55.93               00003  00510
08.27  08.27  06.03-ACC-GEAR          20.6     21.0      .4       .2        1.0      00.00.02       .00               00002  00513
08.27  08.27  06.04-ACC-GEAR          24.3     24.6      .3       .1         .5      00.00.05       .00               00006  00515
08.27  08.27  07.00-DEC-DYNAMIC       23.3     22.5     -.8      -.4       -2.0      00.00.02                         00002  00521
08.27  08.27  04.06-CRUISE            24.7     23.8     -.9      -.5                 00.00.02     10.80               00002  00523
08.27  08.27  04.05-CRUISE            23.1     24.4     1.3       .3                 00.00.04      9.59               00005  00525
08.27  08.27  07.00-DEC-DYNAMIC       21.7       .0   -21.7     -2.7      -13.5      00.00.08                         00009  00530
08.27  08.28  01.00-IDLE                .0       .0      .0                          00.00.20                         00023  00539
08.28  08.28  06.01-ACC-GEAR           4.6      7.4     2.8      1.4        7.0      00.00.02     47.53               00002  00562
08.28  08.28  06.02-ACC-GEAR          14.5     14.5      .0       .0         .0      00.00.03       .00               00003  00564
08.28  08.28  04.03-CRUISE             9.6     17.7     8.1      2.0                 00.00.04     45.93               00005  00567
08.28  08.28  07.00-DEC-DYNAMIC       11.5      7.2    -4.3     -1.4       -7.0      00.00.03                         00003  00572
08.28  08.28  06.02-ACC-GEAR           7.6     11.6     4.0      1.0        5.0      00.00.04    105.36               00005  00575
08.28  08.28  06.03-ACC-GEAR          16.7     23.0     6.3      1.3        6.5      00.00.05     93.51               00006  00580
08.28  08.28  07.00-DEC-DYNAMIC       19.8     18.4    -1.4      -.7       -3.5      00.00.02                         00002  00586
08.28  08.28  04.05-CRUISE            19.5     26.3     6.8      1.4                 00.00.05     84.97               00006  00588
08.28  08.28  10.02-COAST             18.7     18.3     -.4      -.2                 00.00.02                         00002  00594
08.28  08.28  04.06-CRUISE            27.2     23.6    -3.6      -.6                 00.00.06     48.23               00007  00596
08.28  08.28  05.03-ACCELERATION      24.8     27.1     2.3       .6        3.0      00.00.04       .00               00005  00603
08.28  08.28  04.06-CRUISE            23.7     16.9    -6.8      -.9                 00.00.08     35.47               00009  00608
08.28  08.28  10.02-COAST             16.8     15.5    -1.3      -.7                 00.00.02                         00002  00617
08.28  08.29  04.04-CRUISE            15.9     17.3     1.4       .5                 00.00.03     48.95               00003  00619
08.29  08.29  05.03-ACCELERATION      19.2     22.5     3.3       .8        4.0      00.00.04     79.29               00004  00622
08.29  08.29  07.00-DEC-DYNAMIC       18.5       .0   -18.5     -1.5       -7.5      00.00.12                         00014  00626
08.29  08.29  01.00-IDLE                .0       .0      .0                          00.00.38                         00043  00640
08.29  08.29  04.02-CRUISE             7.4      7.7      .3       .1                 00.00.03     57.33               00003  00683
08.29  08.30  04.03-CRUISE            10.7     14.4     3.7       .5                 00.00.08     22.81               00009  00686
08.30  08.30  05.03-ACCELERATION      18.9     19.6      .7       .2        1.0      00.00.04     73.74               00004  00695
08.30  08.30  07.00-DEC-DYNAMIC       17.3     12.6    -4.7      -.9       -4.5      00.00.05                         00006  00699
08.30  08.30  04.04-CRUISE            14.7     15.5      .8       .4                 00.00.02       .00               00002  00705
08.30  08.30  07.00-DEC-DYNAMIC       14.9      1.9   -13.0     -1.2       -6.0      00.00.11                         00013  00707
08.30  08.30  01.00-IDLE                .0       .0      .0                          00.00.17                         00019  00720
08.30  08.30  05.02-ACCELERATION       6.1      9.2     3.1      1.0        5.0      00.00.03     70.[illegible]      00003  00739
08.30  08.30  04.02-CRUISE             7.6      8.9     1.3       .3                 00.00.04     50.39               00004  00742
08.30  08.30  05.02-ACCELERATION      11.8     24.4    12.6      1.1        5.5      00.00.11    178.84               00013  00746
08.30  08.31  04.06-CRUISE            24.1     24.5      .4       .1                 00.00.05    274.21               00006  00759
08.31  08.31  06.03-ACC-GEAR          27.0     30.2     3.2       .4        2.0      00.00.08     91.99               00009  00765
08.31  08.31  06.04-ACC-GEAR          23.0     23.9      .9       .5        2.5      00.00.02       .00               00002  00774
```

Table E-3 (Cont'd.)

SAMPLE OF TYPICAL MODE CHANGE LISTING

```
TRUCK=3, DAY=[illegible]  CITY=N.Y.  TYPE TRUCK=1  FUEL TYPE=GAS     WEIGHT=05  LICENSE=NY662[illegible]FB  INDUSTRY=
ENGINE MODEL=C-G65CCV6    SERIAL NUMBER=                                DAYS SAMPLED=5

START  FINISH   MODE                   INITIAL  PEAK   CHANGE  RATE OF                TIME IN    SUM OF
                                       SPEED    SPEED  SPEED   CHANGE   INTENSITY    MODE       HORSEPOWER

08.31  08.31  06.05-ACC-GEAR           26.5    26.5      .0      .0       .0      00.00.03      33.23      00003  00776
08.31  08.31  04.06-CRUISE             24.1    19.7    -4.4    -1.1               00.00.04      24.22      00004  00779
08.31  08.31  05.04-ACCELERATION       26.4    31.4     5.0      .5      2.5      00.00.10       1.19      00011  00783
08.31  08.31  04.07-CRUISE             33.0    30.6    -2.4     -.6               00.00.04     106.79      00004  00794
08.31  08.31  07.00-DEC-DYNAMIC        29.9    22.5    -7.4     -.8     -4.0      00.00.09                 00010  00798
08.31  08.31  04.06-CRUISE             24.8    27.9     3.1      .3               00.00.10      95.28      00011  00808
08.31  08.31  06.05-ACC-GEAR           27.5    29.3     1.8      .5      2.5      00.00.04      56.94      00005  00819
08.31  08.31  06.04-ACC-GEAR           28.2    28.8      .6      .2      1.0      00.00.04      12.08      00004  00824
08.31  08.32  10.03-COAST              28.7    26.3    -2.4    -1.2               00.00.02                 00002  00828
08.32  08.32  05.04-ACCELERATION       28.9    31.7     2.8      .9      4.5      00.00.03        .02      00003  00830
08.32  08.32  07.00-DEC-DYNAMIC        30.7    29.6    -1.1     -.6     -3.0      00.00.02                 00002  00833
08.32  08.32  04.07-CRUISE             32.2    33.1      .9      .5               00.00.02        .00      00002  00835
08.32  08.32  07.00-DEC-DYNAMIC        31.6    23.1    -8.5    -2.8    -14.0      00.00.03                 00003  00837
08.32  08.32  05.04-ACCELERATION       26.9    29.0     2.1      .4      2.0      00.00.06      60.75      00007  00840
08.32  08.32  07.00-DEC-DYNAMIC        28.7    24.5    -4.2     -.7     -3.5      00.00.06                 00007  00847
08.32  08.32  05.05-ACCELERATION       28.7    29.8     1.1      .3      1.5      00.00.04      10.85      00004  00854
08.32  08.32  07.00-DEC-DYNAMIC        26.9    25.7    -1.2     -.6     -3.0      00.00.02                 00002  00858
08.32  08.32  04.06-CRUISE             27.3    28.0      .7      .1               00.00.09      34.38      00010  00860
08.32  08.32  04.07-CRUISE             29.1    32.1     3.0      .3               00.00.11       8.69      00012  00870
08.32  08.32  07.00-DEC-DYNAMIC        28.1    22.3    -5.8    -2.9    -14.5      00.00.02                 00002  00882
08.32  08.32  05.04-ACCELERATION       26.9    33.7     6.8      .8      4.0      00.00.09      52.76      00010  00884
08.32  08.32  07.00-DEC-DYNAMIC        30.5    22.7    -7.8    -1.6     -8.0      00.00.05                 00006  00894
08.33  08.33  04.06-CRUISE             23.6    24.4      .8      .2               00.00.04      11.65      00005  00900
08.33  08.33  07.00-DEC-DYNAMIC        23.2    22.7     -.5     -.3     -1.5      00.00.02                 00002  00905
08.33  08.33  05.04-ACCELERATION       24.8    31.3     6.5      .6      3.0      00.00.11      20.71      00012  00907
08.33  08.33  07.00-DEC-DYNAMIC        27.5    26.8     -.7     -.4     -2.0      00.00.02                 00002  00919
08.33  08.33  06.04-ACC-GEAR           28.6    28.6      .0      .0       .0      00.00.02      22.67      00002  00921
08.33  08.33  06.05-ACC-GEAR           30.8    32.8     2.0      .3      1.5      00.00.06     224.18      00007  00923
08.33  08.33  06.04-ACC-GEAR           32.0    34.7     2.7      .9      4.5      00.00.03      99.47      00003  00930
08.33  08.33  10.03-COAST              27.8    24.5    -3.3    -1.7               00.00.02                 00002  00933
08.33  08.33  06.04-ACC-GEAR           31.9    33.1     1.2      .4      2.0      00.00.03      95.39      00003  00935
08.33  08.33  06.05-ACC-GEAR           36.1    36.1      .0      .0       .0      00.00.04     124.94      00004  00938
08.33  08.33  04.08-CRUISE             33.8    32.2    -1.6     -.4               00.00.04      55.66      00005  00942
08.33  08.33  07.00-DEC-DYNAMIC        30.7    30.1     -.6     -.3     -1.5      00.00.02                 00002  00947
08.33  08.33  06.04-ACC-GEAR           31.4    34.4     3.0      .3      1.5      00.00.10        .00      00011  00949
08.33  08.33  06.05-ACC-GEAR           34.4    34.8      .4      .1       .5      00.00.04      19.15      00004  00960
08.33  08.34  07.00-DEC-DYNAMIC        31.1    21.2    -9.9    -1.4     -7.0      00.00.07                 00008  00964
08.34  08.34  04.05-CRUISE             21.8    22.9     1.1      .3               00.00.04      69.75      00005  00972
08.34  08.34  06.04-ACC-GEAR           23.9    27.2     3.3      .8      4.0      00.00.04        .00      00005  00977
08.34  08.34  06.05-ACC-GEAR           25.4    25.4      .0      .0       .0      00.00.04        .00      00004  00982
08.34  08.34  06.04-ACC-GEAR           23.3    23.3      .0      .0       .0      00.00.02        .00      00002  00986
08.34  08.34  06.05-ACC-GEAR           23.9    24.5      .6      .2      1.0      00.00.04        .00      00005  00988
08.34  08.34  07.00-DEC-DYNAMIC        19.1     5.8   -13.3    -2.7    -13.5      00.00.05                 00006  00993
08.34  08.34  05.03-ACCELERATION        6.8     8.1     1.3      .2      1.0      00.00.08      19.74      00009  00999
08.34  08.34  04.03-CRUISE             10.2    14.3     4.1     1.4               00.00.03      53.36      00003  01008
08.34  08.34  06.02-ACC-GEAR           14.8    16.6     1.8      .9      4.5      00.00.02      64.15      00002  01011
08.34  08.34  06.03-ACC-GEAR           17.6    22.8     5.2      .3      1.5      00.00.15        .00      00017  01013
08.34  08.34  07.00-DEC-DYNAMIC        20.5    13.9    -6.6    -2.2    -11.0      00.00.03                 00003  01030
08.34  08.35  05.03-ACCELERATION       16.5    17.2      .7      .0       .0      00.00.16        .00      00018  01033
08.35  08.35  07.00-DEC-DYNAMIC        14.1    13.8     -.3     -.1      -.5      00.00.04                 00004  01051
08.35  08.35  04.03-CRUISE             12.7    13.9     1.2      .2               00.00.06       9.97      00007  01055
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Table E-3 (Cont'd.)

SAMPLE OF TYPICAL MODE CHANGE LISTING

```
TRUCK=[illegible]  DAY=3  CITY=N.Y.  TYPE TRUCK=1  FUEL TYPE=GAS      WEIGHT=05  LICENSE=NY6621F6  INDUSTRY=
ENGINE MODEL=GMC650CV6    SERIAL NUMBER=                                DAYS SAMPLED=5

                                        INITIAL  PEAK   CHANGE  RATE OF              TIME IN    SUM OF
START  FINISH    MODE                   SPEED    SPEED  SPEED   CHANGE   INTENSITY   MODE       HORSEPOWER

08.35  08.35  05.03-ACCELERATION        14.4     17.6    3.2      .8       4.0      00.00.04        .00       00004  01062
08.35  08.35  04.04-CRUISE              13.9     12.0   -1.9     -.5                00.00.04      12.38       00004  01066
08.35  08.35  06.03-ACC-GEAR            12.5     14.7    2.2      .6       3.0      00.00.04        .00       00005  01070
08.35  08.35  06.04-ACC-GEAR            13.0     13.0     .0      .0        .0      00.00.04       1.05       00004  01075
08.35  08.35  07.00-DEC-DYNAMIC          9.7       .0   -9.7    -2.4     -12.0      00.00.04                  00005  01079
08.35  08.35  01.00-IDLE                  .0       .0     .0                        00.00.04                  00004  01084
08.35  08.36  06.03-ACC-GEAR             9.2     31.3   22.1      .9       4.5      00.00.24      73.94       00027  01088
08.36  08.36  06.05-ACC-GEAR            34.1     34.1     .0      .0        .0      00.00.03      44.11       00003  01115
08.36  08.36  06.04-ACC-GEAR            29.4     30.6    1.2      .2       1.0      00.00.05      16.43       00006  01118
08.36  08.36  [illegible].03-COAST      30.5     19.4  -11.1    -2.8                00.00.04                  00004  01124
08.36  08.36  04.05-CRUISE              19.5     20.4     .9      .1                00.00.10        .00       00011  01128
08.36  08.36  06.04-ACC-GEAR            23.0     30.3    7.3      .4       2.0      00.00.20      94.96       00023  01135
08.36  08.36  06.05-ACC-GEAR            33.5     33.5     .0      .0        .0      00.00.02      59.16       00002  01162
08.36  08.37  08.00-DEC-POWER           30.5     26.0   -4.5     -.3      -1.5      00.00.17                  00019  01164
08.37  08.37  07.00-DEC-DYNAMIC         30.9     27.9   -3.0    -1.0      -5.0      00.00.03                  00003  01183
08.37  08.37  05.05-ACCELERATION        33.0     33.0     .0      .0        .0      00.00.02        .00       00002  01186
08.37  08.37  07.00-DEC-DYNAMIC         28.0     18.2   -9.8    -2.5     -12.5      00.00.04                  00005  01188
08.37  08.37  04.05-CRUISE              20.9     21.1     .2      .1                00.00.03     114.90       00003  01193
08.37  08.37  04.06-CRUISE              24.8     23.7   -1.1     -.3                00.00.04     187.64       00005  01196
08.37  08.37  05.05-ACCELERATION        31.9     33.0    1.1      .3       1.5      00.00.04     136.20       00004  01201
08.37  08.37  04.07-CRUISE              31.4     31.5     .1      .0                00.00.03      69.10       00003  01205
08.37  08.37  08.00-DEC-POWER           26.1     21.1   -5.0     -.6      -3.0      00.00.09                  00010  01208
08.37  08.37  04.07-CRUISE              32.0     26.3   -5.7    -1.9                00.00.03      49.47       00003  01218
08.37  08.37  05.04-ACCELERATION        32.2     40.1    7.9      .7       3.5      00.00.11     145.93       00012  01221
08.37  08.37  07.00-DEC-DYNAMIC         31.7     29.8   -1.9    -1.0      -5.0      00.00.02                  00002  01233
08.37  08.37  06.04-ACC-GEAR            31.2     38.4    7.2     1.4       7.0      00.00.05        .00       00006  01235
08.37  08.37  06.05-ACC-GEAR            36.1     37.1    1.0      .3       1.5      00.00.04     127.57       00005  01241
08.38  08.38  06.04-ACC-GEAR            32.8     36.2    3.4     1.1       5.5      00.00.03      73.67       00003  01246
08.38  08.38  04.08-CRUISE              34.7     27.1   -7.6    -2.5                00.00.03      85.10       00003  01249
08.38  08.38  06.04-ACC-GEAR            34.2     34.2     .0      .0        .0      00.00.02      52.55       00002  01252
08.38  08.38  06.05-ACC-GEAR            39.0     39.0     .0      .0        .0      00.00.03     106.15       00003  01254
08.38  08.38  06.04-ACC-GEAR            34.3     34.3     .0      .0        .0      00.00.02      73.58       00002  01257
08.38  08.38  06.05-ACC-GEAR            38.5     38.5     .0      .0        .0      00.00.04     149.56       00005  01259
08.38  08.38  08.00-DEC-POWER           30.8     25.3   -5.5     -.9      -4.5      00.00.06                  00007  01264
08.38  08.38  05.04-ACCELERATION        28.2     38.3   10.1      .6       3.0      00.00.17     201.85       00019  01271
08.38  08.38  04.08-CRUISE              34.6     18.6  -16.0    -4.0                00.00.04      43.18       00005  01290
08.38  08.38  05.04-ACCELERATION        27.8     41.0   13.2     1.0       5.0      00.00.13       1.44       00015  01295
08.38  08.38  04.07-CRUISE              28.6     30.0    1.4      .7                00.00.02      51.10       00002  01310
08.38  08.39  05.04-ACCELERATION        38.1     43.0    4.9     1.2       6.0      00.00.04      80.56       00004  01312
08.39  08.39  07.00-DEC-DYNAMIC         35.3     16.1  -19.2    -3.2     -16.0      00.00.06                  00007  01316
08.39  08.39  08.00-DEC-POWER           34.6     33.6   -1.0     -.1       -.5      00.00.08                  00009  01323
08.39  08.39  04.08-CRUISE              35.5     35.8     .3      .3                00.00.02      31.17       00002  01332
08.39  08.39  06.04-ACC-GEAR            38.3     41.3    3.0      .8       4.0      00.00.04      94.45       00004  01334
08.39  08.39  06.05-ACC-GEAR            45.5     45.5     .0      .0        .0      00.00.03      67.38       00003  01338
08.39  08.39  04.09-CRUISE              42.9     42.8    -.1     -.1                00.00.02      53.67       00002  01341
08.39  08.39  04.10-CRUISE              43.9     44.1     .2      .1                00.00.02      58.65       00002  01343
08.39  08.39  08.00-DEC-POWER           33.7     26.6   -7.1    -1.4      -7.0      00.00.05                  00006  01345
08.39  08.39  04.09-CRUISE              42.8     31.6  -11.2    -1.9                00.00.06     121.17       00007  01351
08.39  08.39  05.04-ACCELERATION        42.1     42.5     .4      .1        .5      00.00.04     108.07       00004  01358
08.39  08.39  08.00-DEC-POWER           40.0     36.9   -3.1     -.5      -2.5      00.00.06                  00007  01362
08.39  08.39  04.10-CRUISE              43.6     45.3    1.7      .3                00.00.06      39.26       00007  01369
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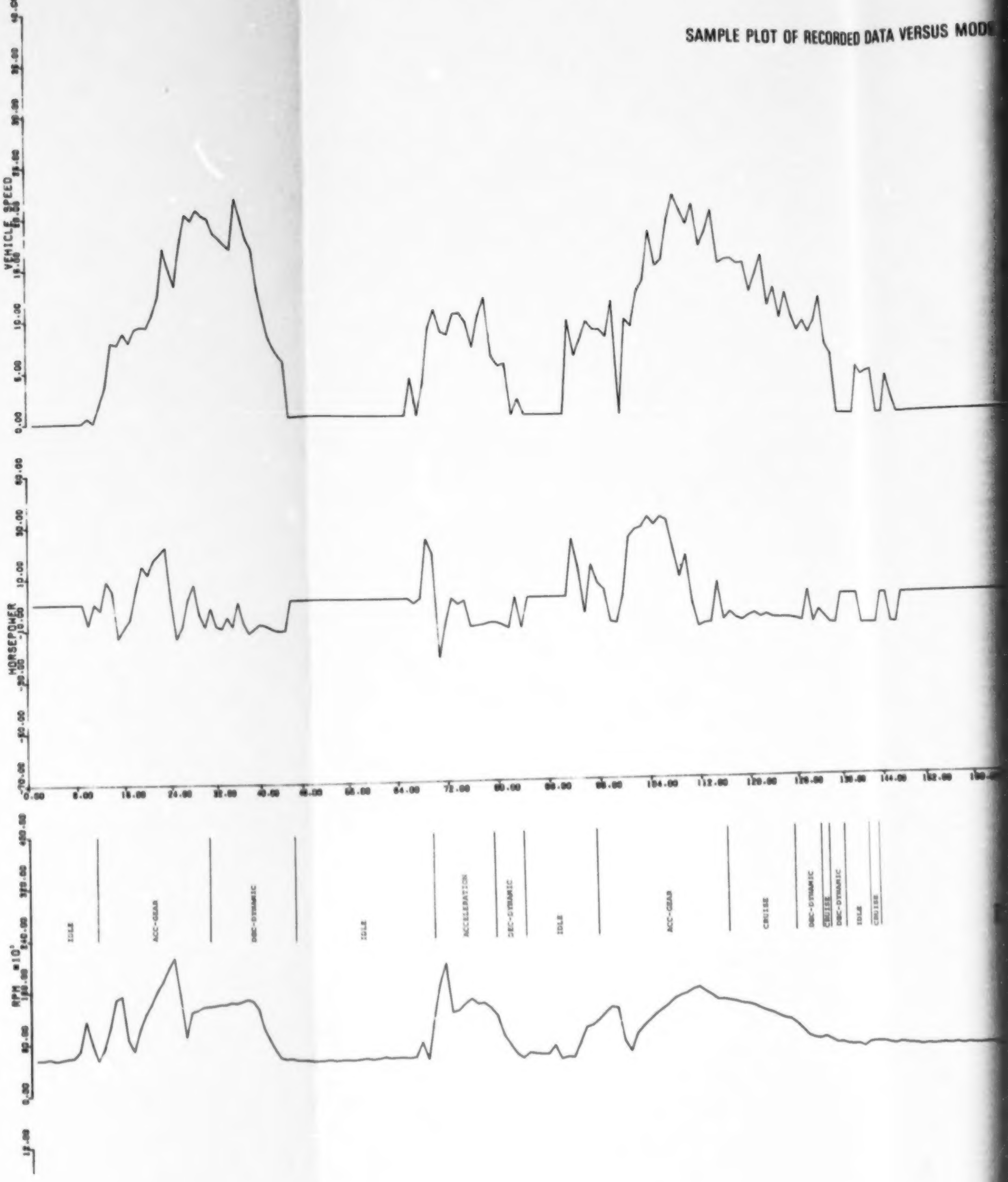
Table E-3 (Cont'd.)

SAMPLE OF TYPICAL MODE CHANGE LISTING

TRUCK=31 DAY=3 CITY=N.Y. TYPE TRUCK=1 FUEL TYPE=GAS WEIGHT=05 LICENSE=NY6621HB INDUSTRY=
ENGINE MODEL=GMC6500V6 SERIAL NUMBER= DAYS SAMPLED=5

START	FINISH	MODE	INITIAL SPEED	PEAK SPEED	CHANGE SPEED	RATE OF CHANGE	INTENSITY	TIME IN MODE	SUM OF HORSEPOWER		
08.39	08.39	05.05-ACCELERATION	47.7	50.3	2.6	.5	2.5	00.00.05	.54	00006	01376
08.39	08.39	07.00-DEC-DYNAMIC	48.9	47.9	-1.0	-.5	-2.5	00.00.02		00002	01382
08.39	08.40	04.11-CRUISE	49.1	51.0	1.9	1.0		00.00.02	.00	00002	01384
08.40	08.40	07.00-DEC-DYNAMIC	48.7	46.1	-2.6	-.7	-3.5	00.00.04		00005	01386
08.40	08.40	04.10-CRUISE	46.4	48.1	1.7	.9		00.00.02	.00	00002	01391
08.40	08.40	07.00-DEC-DYNAMIC	46.6	45.5	-1.1	-.3	-1.5	00.00.04		00004	01393
08.40	08.40	04.10-CRUISE	46.4	43.6	-2.8	-.1		00.00.19	97.74	00022	01397
08.40	08.40	08.00-DEC-POWER	41.7	39.1	-2.6	-.2	-1.0	00.00.17		00019	01419
08.40	08.40	04.09-CRUISE	42.8	41.9	-.9	-.3		00.00.03	38.56	00003	01438
08.40	08.40	08.00-DEC-POWER	40.0	30.1	-9.9	-1.2	-6.0	00.00.08		00009	01441
08.40	08.40	05.04-ACCELERATION	38.3	41.6	3.3	1.1	5.5	00.00.03	.00	00003	01450
08.40	08.41	07.00-DEC-DYNAMIC	39.7	34.6	-5.1	-1.3	-6.5	00.00.04		00004	01453
08.41	08.41	04.08-CRUISE	34.6	32.9	-1.7	-.2		00.00.07	.00	00008	01457
08.41	08.41	05.04-ACCELERATION	35.2	38.6	3.4	.3	1.5	00.00.13	9.52	00015	01465
08.41	08.41	04.07-CRUISE	31.4	33.7	2.3	.6		00.00.04	.00	00005	01480
08.41	08.41	07.00-DEC-DYNAMIC	30.4	23.9	-6.5	-1.3	-6.5	00.00.05		00006	01485
08.41	08.41	06.05-ACC-GEAR	26.0	26.0	.0	.0	.0	00.00.07	.00	00008	01491
08.41	08.41	06.04-ACC-GEAR	17.7	20.2	2.5	.3	1.5	00.00.10	.00	00011	01499
08.41	08.41	04.03-CRUISE	10.7	4.1	-6.6	-1.3		00.00.05	.00	00006	01510
08.41	08.41	07.00-DEC-DYNAMIC	1.0	.5	-.5	-.1	-.5	00.00.04		00004	01516
08.41	08.42	04.01-CRUISE	.5	.8	.3	.0		00.00.13	.00	00015	01520
08.42	08.42	10.01-COAST	.7	.5	-.2	-.1		00.00.03		00003	01535
08.42	08.42	07.00-DEC-DYNAMIC	.5	.0	-.5	-.2	-1.0	00.00.03		00003	01538
08.42	08.42	04.01-CRUISE	.7	.7	.0	.0		00.00.11	.00	00013	01541
08.42	08.42	01.00-IDLE	.0	.0	.0			00.00.04		00004	01554
08.42	08.42	04.01-CRUISE	.8	.9	.1	.1		00.00.02	.00	00002	01558
08.42	08.42	07.00-DEC-DYNAMIC	.7	.0	-.7	-.1	-.5	00.00.05		00006	01560
08.42	08.42	06.01-ACC-GEAR	6.3	7.9	1.6	.5	2.5	00.00.03	23.53	00003	01566
08.42	08.42	06.03-ACC-GEAR	11.5	11.5	.0	.0	.0	00.00.03	.00	00003	01569
08.42	08.42	07.00-DEC-DYNAMIC	6.6	5.8	-.8	-.1	-.5	00.00.06		00007	01572
08.42	08.42	05.02-ACCELERATION	6.4	8.9	2.5	.2	1.0	00.00.11	22.78	00012	01579
08.42	08.43	07.00-DEC-DYNAMIC	5.8	4.8	-1.0	-.3	-1.5	00.00.04		00004	01591
08.43	08.43	04.02-CRUISE	5.1	6.2	1.1	.6		00.00.02	28.13	00002	01595
08.43	08.43	06.02-ACC-GEAR	9.9	19.0	9.1	2.3	11.5	00.00.04	123.21	00005	01597
08.43	08.43	06.03-ACC-GEAR	17.2	19.3	2.1	.5	2.5	00.00.04	65.52	00005	01602
08.43	08.43	06.04-ACC-GEAR	22.5	25.1	2.6	.7	3.5	00.00.04	62.97	00005	01607
08.43	08.43	06.03-ACC-GEAR	21.7	27.8	6.1	.3	1.5	00.00.18	27.10	00021	01612
08.43	08.43	07.00-DEC-DYNAMIC	27.0	14.8	-12.2	-.7	-3.5	00.00.17		00019	01633
08.43	08.43	10.01-COAST	9.3	8.6	-.7	-.4		00.00.02		00002	01652
08.43	08.43	05.03-ACCELERATION	11.4	14.1	2.7	.5	2.5	00.00.05	.00	00006	01654
08.43	08.43	04.03-CRUISE	10.3	13.4	3.1	1.6		00.00.02	12.09	00002	01660
08.43	08.44	07.00-DEC-DYNAMIC	10.6	10.2	-.4	-.1	-.5	00.00.04		00005	01662
08.44	08.44	05.03-ACCELERATION	13.4	21.8	8.4	.4	2.0	00.00.19	.00	00022	01667
08.44	08.44	07.00-DEC-DYNAMIC	16.8	10.3	-6.5	-1.3	-6.5	00.00.05		00006	01689
08.44	08.44	06.03-ACC-GEAR	11.0	14.0	3.0	.6	3.0	00.00.05	.00	00006	01695
08.44	08.44	06.04-ACC-GEAR	14.0	14.0	.0	.0	.0	00.00.04	.00	00004	01701
08.44	08.44	01.00-IDLE	.0	.0	.0			00.00.11		00013	01705
08.44	08.44	06.01-ACC-GEAR	3.0	3.3	.3	.1	.5	00.00.03	.00	00003	01718
08.44	08.44	06.03-ACC-GEAR	5.8	5.8	.0	.0	.0	00.00.02	.00	00002	01721
08.44	08.44	07.00-DEC-DYNAMIC	4.4	.0	-4.4	-1.1	-5.5	00.00.04		00005	01723
08.44	08.45	01.00-IDLE	.0	.0	.0			00.00.11		00012	01728

SAMPLE PLOT OF RECORDED DATA VERSUS MODE



OT OF RECORDED DATA VERSUS MODE DETERMINATION

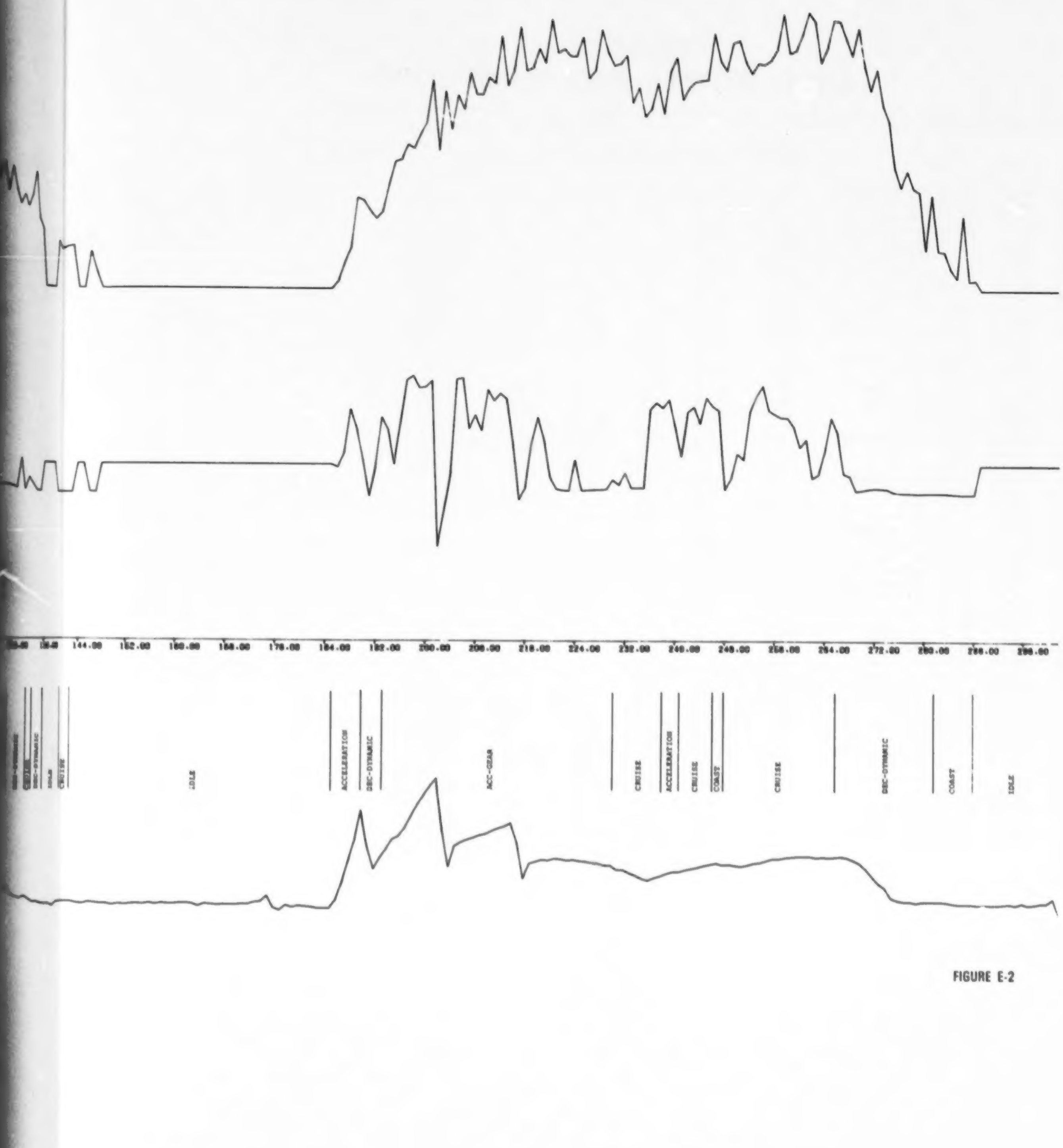


FIGURE E-2

TABLE E-4

SAMPLE OF MODE SUMMARY LISTING

```
TRUCK=31  CITY=N.Y.  TYPE TRUCK=1  FUEL TYPE=GAS     WEIGHT=05  LICENSE=NY6621HB  INDUSTRY=
ENGINE MODEL=GMC65CCV8    SERIAL NUMBER=                        DAYS SAMPLED=5  DAY=3

                                  --- MEAN TIME ---    VARIANCE  DEVIATION    TRANSITION
   MODE                FREQUENCY  SECONDS  HH.MM.SS     SECONDS   HH.MM.SS    PROBABILITY

 1.00-IDLE
     3.00-HOT-SOAK             7   524.56  00.08.45 725,188.600   00.08.45          5.19
     4.01-CRUISE              23    13.89  00.00.14     436.200   00.00.14         17.04
     4.02-CRUISE               9    16.13  00.00.16     157.159   00.00.16          6.67
     4.03-CRUISE               2     7.48  00.00.07       9.636   00.00.07          1.48
     5.01-ACCELERATION        27   123.43  00.02.03 133,048.499   00.02.03         20.00
     5.02-ACCELERATION        13    20.04  00.00.20     146.285   00.00.20          9.63
     5.03-ACCELERATION         3    11.44  00.00.11      71.922   00.00.11          2.22
     6.01-ACC-GEAR            29   153.30  00.02.33 501,750.946   00.02.33         21.48
     6.02-ACC-GEAR            12    17.45  00.00.17     125.602   00.00.17          8.89
     6.03-ACC-GEAR             3     3.81  00.00.04       1.792   00.00.04          2.22
     6.04-ACC-GEAR             2     2.20  00.00.02        .378   00.00.00          1.48
    10.01-COAST                5    96.62  00.01.37  28,035.390   00.01.37          3.70

 3.00-HOT-SOAK
     1.00-IDLE                 6   659.56  00.11.00 344,288.909   00.11.00        100.00

 4.01-CRUISE
     1.00-IDLE                18     3.18  00.00.03       6.552   00.00.03         38.30
     4.03-CRUISE               1     1.76  00.00.02        .000   00.00.00          2.13
     5.01-ACCELERATION         3     3.23  00.00.03       3.335   00.00.03          6.38
     6.01-ACC-GEAR             5     2.46  00.00.02        .151   00.00.00         10.64
     7.00-DEC-DYNAMIC         18     2.84  00.00.03       3.497   00.00.03         38.30
    10.01-COAST                2     7.48  00.00.07      65.322   00.00.07          4.26

 4.02-CRUISE
     1.00-IDLE                 1     1.76  00.00.02        .000   00.00.00          2.78
     4.01-CRUISE               1     4.40  00.00.04        .000   00.00.00          2.78
     4.03-CRUISE               7     3.65  00.00.04       2.675   00.00.04         19.44
     4.04-CRUISE               1     7.04  00.00.07        .000   00.00.00          2.78
     5.01-ACCELERATION         3     3.81  00.00.04       4.106   00.00.04          8.33
     5.02-ACCELERATION         2     3.52  00.00.04        .000   00.00.00          5.56
     5.03-ACCELERATION         1     2.64  00.00.03        .000   00.00.00          2.78
     6.01-ACC-GEAR             1     4.40  00.00.04        .000   00.00.00          2.78
     6.02-ACC-GEAR             5     2.99  00.00.03       2.154   00.00.03         13.89
     6.03-ACC-GEAR             1     5.29  00.00.05        .000   00.00.00          2.78
     7.00-DEC-DYNAMIC         13     3.05  00.00.03       4.835   00.00.03         36.11

 4.03-CRUISE
     4.02-CRUISE               2     3.08  00.00.03       3.458   00.00.03          3.70
     4.04-CRUISE               6     3.23  00.00.03       2.976   00.00.03         11.11
     5.02-ACCELERATION         3     2.64  00.00.03        .000   00.00.00          5.56
     5.03-ACCELERATION         7     4.07  00.00.04       4.589   00.00.04         12.96
     5.04-ACCELERATION         2    10.56  00.00.11       1.531   00.00.11          3.70
     6.01-ACC-GEAR             1     4.40  00.00.04        .000   00.00.00          1.85
     6.02-ACC-GEAR             9     3.91  00.00.04       3.295   00.00.04         16.67
     6.03-ACC-GEAR             1     7.04  00.00.07        .000   00.00.00          1.85
     7.00-DEC-DYNAMIC         19     3.29  00.00.03       3.583   00.00.03         35.19
     8.00-DEC-POWER            2     3.96  00.00.04       3.458   00.00.04          3.70
    10.01-COAST                1     1.76  00.00.02        .000   00.00.00          1.85
    10.02-COAST                1     6.16  00.00.06        .000   00.00.00          1.85
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TABLE E-4 (Cont'd.)
SAMPLE OF MODE SUMMARY LISTING

```
TRUCK=01  CITY=N.Y.  TYPE TRUCK=V  FUEL TYPE=GAS      WEIGHT=05  LICENSE=NY6621HB  INDUSTRY=
ENGINE MODEL=GMC/500V6   SERIAL NUMBER==                       DAYS SAMPLED=5  DAY=3

                                    --- MEAN TIME ---     VARIANCE  DEVIATION    TRANSITION
   MODE                FREQUENCY  SECONDS  HH.MM.SS       SECONDS    HH.MM.SS    PROBABILITY

4.04-CRUISE
    4.02-CRUISE                1     4.40  00.00.04          .000   00.00.00          2.63
    4.03-CRUISE                2     5.72  00.00.06          .378   00.00.00          5.26
    4.05-CRUISE                4     2.64  00.00.03          .510   00.00.00         10.53
    5.02-ACCELERATION          1     2.64  00.00.03          .000   00.00.00          2.63
    5.03-ACCELERATION          8     4.18  00.00.04         1.702   00.00.04         21.05
    5.04-ACCELERATION          2     2.64  00.00.03         1.531   00.00.03          5.26
    5.05-ACCELERATION          2     3.08  00.00.03          .378   00.00.00          5.26
    6.02-ACC-GEAR              1     2.64  00.00.03          .000   00.00.00          2.63
    6.03-ACC-GEAR              1     3.52  00.00.04          .000   00.00.00          2.63
    6.04-ACC-GEAR              1     4.40  00.00.04          .000   00.00.00          2.63
    7.00-DEC-DYNAMIC          11     4.48  00.00.04        17.693   00.00.04         28.95
   10.02-COAST                 4     6.82  00.00.07        20.800   00.00.07         10.53

4.05-CRUISE
    4.04-CRUISE                2     5.16  00.00.06         1.531   00.00.06          4.08
    4.06-CRUISE                9     3.72  00.00.04         3.619   00.00.04         18.37
    5.03-ACCELERATION          3     2.35  00.00.02          .252   00.00.00          6.12
    5.04-ACCELERATION          6     4.84  00.00.05        17.230   00.00.05         12.24
    5.05-ACCELERATION          3     7.33  00.00.07        23.440   00.00.07          6.12
    6.03-ACC-GEAR              3     6.16  00.00.06        21.630   00.00.06          6.12
    6.04-ACC-GEAR              3     6.45  00.00.06         7.969   00.00.06          6.12
    7.00-DEC-DYNAMIC          14     4.09  00.00.04         5.056   00.00.04         28.57
    8.00-DEC-POWER             1     1.76  00.00.02          .000   00.00.00          2.04
   10.02-COAST                 4     3.74  00.00.04         3.270   00.00.04          8.16
   10.03-COAST                 1     4.40  00.00.04          .000   00.00.00          2.04

4.06-CRUISE
    4.05-CRUISE                5     3.70  00.00.04         3.233   00.00.04          9.80
    4.07-CRUISE                6     5.13  00.00.05         7.227   00.00.05         11.76
    4.08-CRUISE                1     1.76  00.00.02          .000   00.00.00          1.96
    5.03-ACCELERATION          4     4.18  00.00.04         2.244   00.00.04          7.84
    5.04-ACCELERATION          8     3.52  00.00.04         1.317   00.00.04         15.69
    5.05-ACCELERATION          1     4.40  00.00.04          .000   00.00.00          1.96
    6.03-ACC-GEAR              2     6.16  00.00.06         1.531   00.00.06          3.92
    6.04-ACC-GEAR              3     2.35  00.00.02         1.020   00.00.02          5.88
    6.05-ACC-GEAR              1     9.68  00.00.10          .000   00.00.00          1.96
    7.00-DEC-DYNAMIC          14     4.02  00.00.04         5.783   00.00.04         27.45
    8.00-DEC-POWER             4     5.06  00.00.05        20.800   00.00.05          7.84
   10.02-COAST                 2     4.84  00.00.05        18.911   00.00.05          3.92

4.07-CRUISE
    4.06-CRUISE                4     2.42  00.00.02          .701   00.00.00         10.81
    4.08-CRUISE                1     3.52  00.00.04          .000   00.00.00          2.70
    5.03-ACCELERATION          3     4.99  00.00.05        11.061   00.00.05          8.11
    5.04-ACCELERATION          7     4.65  00.00.05         8.678   00.00.05         18.92
    6.03-ACC-GEAR              1     7.04  00.00.07          .000   00.00.00          2.70
    6.04-ACC-GEAR              2     3.52  00.00.04         1.531   00.00.04          5.41
    7.00-DEC-DYNAMIC           7     4.27  00.00.04        10.408   00.00.04         18.92
    8.00-DEC-POWER             5     3.87  00.00.04         7.951   00.00.04         13.51
   10.02-COAST                 7     3.02  00.00.03         2.014   00.00.03         18.92
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TABLE E-4 (Cont'd.)

SAMPLE OF MODE SUMMARY LISTING

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TRUCK=21  CITY=N.Y.  TYP  TRUCK=1  FUEL TYPE=GAS      WEIGHT=05  LICENSE=NY6621HB  INDUSTRY=
ENGINE MODEL=GMC65CCV6   SERIAL NUMBER=                          DAYS SAMPLED=5  DAY=3

                                  --- MEAN TIME ---    VARIANCE  DEVIATION   TRANSITION
    MODE               FREQUENCY  SECONDS  HH.MM.SS    SECONDS    HH.MM.SS   PROBABILITY

 4.08-CRUISE
     4.07-CRUISE             1      4.40  00.00.04        .000   00.00.00          4.55
     4.09-CRUISE             5      5.10  00.00.05       6.712   00.00.05         22.73
     5.04-ACCELERATION       8      5.94  00.00.06      14.291   00.00.06         36.36
     6.04-ACC-GEAR           3      3.23  00.00.03       3.335   00.00.03         13.64
     7.00-DEC-DYNAMIC        3      2.64  00.00.03       2.305   00.00.03         13.64
     8.00-DEC-POWER          2      1.76  00.00.02        .000   00.00.00          9.09

 4.09-CRUISE
     4.08-CRUISE             5      3.70  00.00.04       5.941   00.00.04         16.67
     4.10-CRUISE             5      3.87  00.00.04       6.404   00.00.04         16.67
     5.04-ACCELERATION       7      6.29  00.00.06       7.057   00.00.06         23.33
     5.05-ACCELERATION       2      5.28  00.00.05       6.160   00.00.05          6.67
     6.04-ACC-GEAR           4      7.92  00.00.08      31.439   00.00.08         13.33
     7.00-DEC-DYNAMIC        1      7.04  00.00.07        .000   00.00.00          3.33
     8.00-DEC-POWER          3      2.93  00.00.03       1.792   00.00.03         10.00
    10.04-COAST              3      4.40  00.00.04       9.257   00.00.04         10.00

 4.10-CRUISE
     4.07-CRUISE             1      8.80  00.00.09        .000   00.00.00          3.13
     4.09-CRUISE             6      7.19  00.00.07      23.932   00.00.07         18.75
     4.11-CRUISE             3      3.52  00.00.04       9.257   00.00.04          9.38
     5.04-ACCELERATION       2      3.52  00.00.04       1.531   00.00.04          6.25
     5.05-ACCELERATION       2      5.28  00.00.05       1.531   00.00.05          6.25
     6.04-ACC-GEAR           1     16.72  00.00.17        .000   00.00.00          3.13
     7.00-DEC-DYNAMIC        7      6.29  00.00.06      49.098   00.00.06         21.88
     8.00-DEC-POWER          4      7.70  00.00.08      65.681   00.00.08         12.50
    10.04-COAST              1      2.64  00.00.03        .000   00.00.00          3.13
    10.05-COAST              5      7.57  00.00.08      11.814   00.00.08         15.63

 4.11-CRUISE
     4.10-CRUISE             4      6.16  00.00.06       9.779   00.00.06         57.14
     6.04-ACC-GEAR           1      2.64  00.00.03        .000   00.00.00         14.29
     7.00-DEC-DYNAMIC        2      2.64  00.00.03       1.531   00.00.03         28.57

 5.01-ACCELERATION
     1.00-IDLE               5      3.17  00.00.03        .611   00.00.00         10.64
     4.01-CRUISE             3      5.26  00.00.05       9.257   00.00.05          6.38
     4.02-CRUISE             3      8.21  00.00.08       7.198   00.00.08          6.38
     4.03-CRUISE             1     15.84  00.00.16        .000   00.00.00          2.13
     7.00-DEC-DYNAMIC       30      6.10  00.00.06      10.224   00.00.06         63.83
    10.01-COAST              5      7.74  00.00.08      10.967   00.00.08         10.64

 5.02-ACCELERATION
     1.00-IDLE               1      8.80  00.00.09        .000   00.00.00          3.03
     4.02-CRUISE             2      3.96  00.00.04       3.458   00.00.04          6.06
     4.03-CRUISE             3      6.75  00.00.07      15.705   00.00.07          9.09
     4.05-CRUISE             3      7.04  00.00.07       3.080   00.00.07          9.09
     4.06-CRUISE             1     11.44  00.00.11        .000   00.00.00          3.03
     7.00-DEC-DYNAMIC       23      6.20  00.00.06       6.139   00.00.06         69.70
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TABLE E-4 (Cont'd.)

SAMPLE OF MODE SUMMARY LISTING

```
TRUCK=31  CITY=N.Y.  TYPE TRUCK=1  FUEL TYPE=GAS     WEIGHT=05  LICENSE=NY6621HB  INDUSTRY=
ENGINE MODEL=GMC6500V6   SERIAL NUMBER=                        DAYS SAMPLED=5  DAY=2

                                    --- MEAN TIME ---    VARIANCE  DEVIATION   TRANSITION
   MODE                 FREQUENCY  SECONDS  HH.MM.SS     SECONDS   HH.MM.SS   PROBABILITY

 5.03-ACCELERATION
     4.03-CRUISE               5      4.75  00.00.05       4.085   00.00.05          7.94
     4.04-CRUISE               2      3.81  00.00.04       1.792   00.00.04          4.76
     4.05-CRUISE               4      5.94  00.00.06      11.002   00.00.06          6.35
     4.06-CRUISE               3      5.87  00.00.06       3.335   00.00.06          4.76
     4.07-CRUISE               2     13.64  00.00.14     111.751   00.00.14          3.17
     7.00-DEC-DYNAMIC         41      8.41  00.00.08      24.894   00.00.08         65.08
     8.00-DEC-POWER            2     12.76  00.00.13      86.988   00.00.13          3.17
    10.01-COAST                1      4.40  00.00.04        .000   00.00.00          1.59
    10.02-COAST                2      5.72  00.00.06        .378   00.00.00          3.17

 5.04-ACCELERATION
     1.00-IDLE                 1      2.64  00.00.03        .000   00.00.00          1.02
     4.03-CRUISE               1      2.64  00.00.03        .000   00.00.00          1.02
     4.04-CRUISE               2      6.60  00.00.07      46.754   00.00.07          2.04
     4.05-CRUISE               6      9.53  00.00.10      15.580   00.00.10          6.12
     4.06-CRUISE               5      9.86  00.00.10      69.373   00.00.10          5.10
     4.07-CRUISE               9      7.72  00.00.08      18.113   00.00.08          9.18
     4.08-CRUISE               6      6.89  00.00.07      26.108   00.00.07          6.12
     4.09-CRUISE               5      8.45  00.00.08       7.561   00.00.08          5.10
     4.10-CRUISE               6     14.23  00.00.14     240.356   00.00.14          6.12
     4.11-CRUISE               2     12.76  00.00.13     111.751   00.00.13          2.04
     7.00-DEC-DYNAMIC         44      6.14  00.00.06      33.227   00.00.06         44.90
     8.00-DEC-POWER            4      4.84  00.00.05       7.459   00.00.05          4.08
    10.03-COAST                4     10.34  00.00.10     120.893   00.00.10          4.08
    10.04-COAST                2     10.56  00.00.11       1.531   00.00.11          2.04
    10.05-COAST                1     18.48  00.00.18        .000   00.00.00          1.02

 5.05-ACCELERATION
     4.04-CRUISE               1      2.64  00.00.03        .000   00.00.00          7.14
     4.05-CRUISE               1      2.64  00.00.03        .000   00.00.00          7.14
     4.06-CRUISE               1      5.28  00.00.05        .000   00.00.00          7.14
     4.07-CRUISE               1      3.52  00.00.04        .000   00.00.00          7.14
     4.09-CRUISE               1      3.52  00.00.04        .000   00.00.00          7.14
     4.10-CRUISE               2      3.52  00.00.04       1.531   00.00.04         14.29
     7.00-DEC-DYNAMIC          6      3.08  00.00.03       1.768   00.00.03         42.86
    10.04-COAST                1      1.76  00.00.02        .000   00.00.00          7.14

 6.01-ACC-GEAR
     4.04-CRUISE               1      5.28  00.00.05        .000   00.00.00          1.85
     6.02-ACC-GEAR            37      4.09  00.00.04       8.590   00.00.04         68.52
     6.03-ACC-GEAR            11      5.20  00.00.05       9.179   00.00.05         20.37
     6.04-ACC-GEAR             1      5.28  00.00.05        .000   00.00.00          1.85
     7.00-DEC-DYNAMIC          4      4.62  00.00.05       8.426   00.00.05          7.41

 6.02-ACC-GEAR
     1.00-IDLE                 1      9.68  00.00.10        .000   00.00.00           .95
     4.01-CRUISE               1      6.16  00.00.06        .000   00.00.00           .95
     4.03-CRUISE               3      4.59  00.00.05       4.106   00.00.05          2.86
     4.04-CRUISE               2      7.46  00.00.07      46.754   00.00.07          1.90
     6.01-ACC-GEAR             9      2.44  00.00.02        .916   00.00.00          8.57
     6.03-ACC-GEAR            63      5.20  00.00.05      10.432   00.00.05         60.00
     6.04-ACC-GEAR             5      5.40  00.00.05       3.623   00.00.05          4.76
```

Table E-5
SAMPLE OF MODE FREQUENCY MATRIX

TRUCK=31 CITY=N.Y. TYPE TRUCK=1 FUEL TYPE=GAS WEIGHT=05 LICENSE=NY6621HB INDUSTRY=
ENGINE MODEL=GMC/5CCV8 SERIAL NUMBER= DAYS SAMPLED=5 DAY=3

MODE FREQUENCY MATRIX

	1.00 IDLE	2.00 STOP	3.00 SOAK	4.00 CRUISE	5.00 ACC	6.00 ACC-GEAR	7.00 DEC-DYN	8.00 DEC-PWR	9.00 DEC-THC	10.00 COAST
1.00-IDLE	0	0	7	34	43	46	0	0	0	5
2.00-STOP	0	0	0	0	0	0	0	0	0	0
3.00-HOT-SOAK	8	0	0	0	0	0	0	0	0	0
4.00-CRUISE	19	0	0	83	90	50	109	21	0	31
5.00-ACCELERATION	7	0	0	82	0	0	144	6	0	16
6.00-ACC-GEAR	2	0	0	47	0	235	82	8	0	13
7.00-DEC-DYNAMIC	88	0	1	106	88	50	0	5	0	17
8.00-DEC-POWER	0	0	0	19	17	2	2	0	0	3
9.00-DEC-THROT-CLSD	0	0	0	0	0	0	0	0	0	0
10.00-COAST	11	0	0	32	17	4	18	3	0	2

Table E-6
SAMPLE OF MEAN TIME IN MODE MATRIX

```
TRUCK=01  CITY=N.Y.  TYPE TRUCK=1  FUEL TYPE=GAS     WEIGHT=05  LICENSE=NY6621HB  INDUSTRY=
ENGINE MODEL=[illegible]   SERIAL NUMBER=                        DAYS SAMPLED=5  DAY=3

MEAN TIME IN MODE MATRIX

TIME IN HOURS.MINUTES.SECONDS

                       1.00      2.00      3.00      4.00      5.00      6.00      7.00      8.00      9.00     10.00
                       IDLE      STOP      SOAK    CRUISE       ACC  ACC-GEAR   DEC-DYN   DEC-PWR   DEC-THC     COAST

 1.00-IDLE         00.00.00  00.00.00  00.08.45  00.00.14  00.01.24  00.01.42  00.00.00  00.00.00  00.00.00  00.01.37

 2.00-STOP         00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00

 3.00-HOT-SOAK     00.11.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00

 4.00-CRUISE       00.00.03  00.00.00  00.00.00  00.00.04  00.00.05  00.00.05  00.00.04  00.00.04  00.00.00  00.00.05

 5.00-ACCELERATION 00.00.04  00.00.00  00.00.00  00.00.08  00.00.00  00.00.00  00.00.07  00.00.07  00.00.00  00.00.09

 6.00-ACC-GEAR     00.00.07  00.00.00  00.00.00  00.00.04  00.00.00  00.00.05  00.00.05  00.00.08  00.00.00  00.00.06

 7.00-DEC-DYNAMIC  00.00.07  00.00.00  00.00.06  00.00.04  00.00.05  00.00.05  00.00.00  00.00.06  00.00.00  00.00.06

 8.00-DEC-POWER    00.00.00  00.00.00  00.00.00  00.00.05  00.00.06  00.00.05  00.00.12  00.00.00  00.00.00  00.00.09

 9.00-DEC-THROT-CLSD 00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00  00.00.00

10.00-COAST        00.00.04  00.00.00  00.00.00  00.00.03  00.00.03  00.00.02  00.00.05  00.00.03  00.00.00  00.00.07
```

Appendix F

EQUIPMENT INSTALLATION PROCEDURES

The following is a detailed description of the step-by-step installation procedures:

Signal Conditioner and Data Logger:

Install data acquisition cabinet in place at passenger location in truck cab. (See Figure F-1.) Adjust braces and clamps to secure platform. Install battery and case, and secure. Exact location is determined for each installation. Connect power cable to Signal Conditioning Box terminals: (+) to No. 1, (-) to No. 2.

Vehicle Speed Transducer

a. Disconnect speedometer cable from speedometer.

b. Insert speedometer cable tee into line between speedometer head and cable.

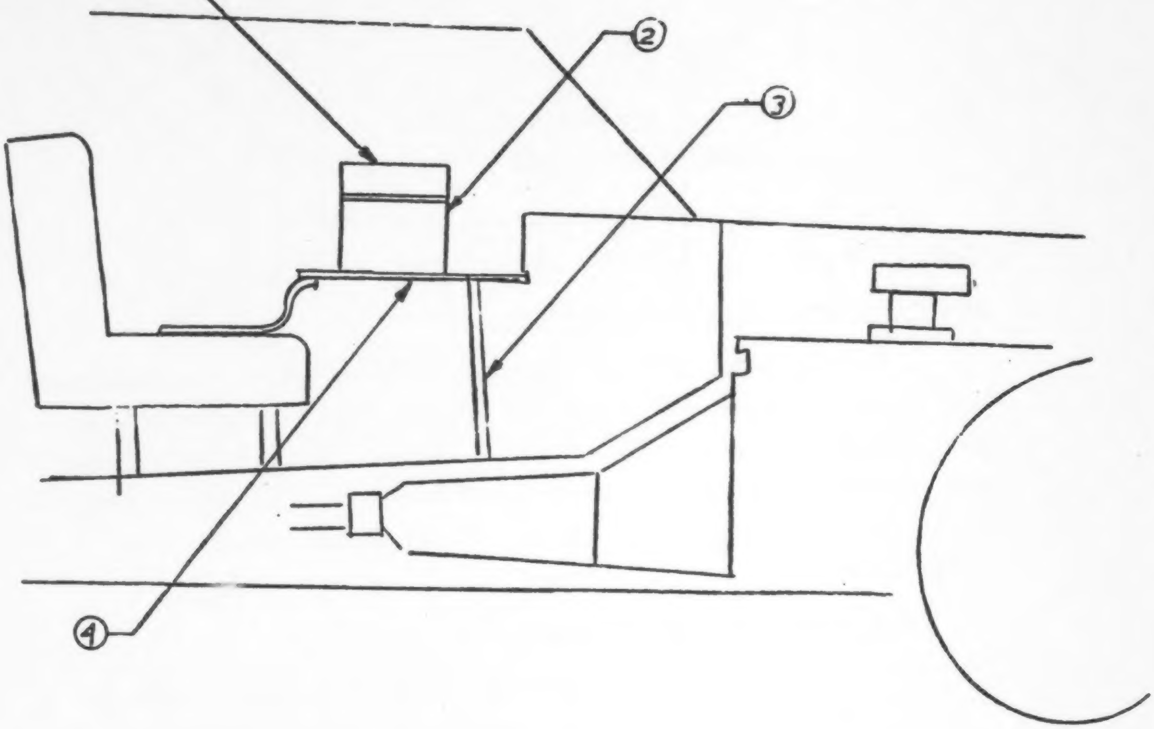
c. Connect speed transducer to tee using short extender cable, if necessary.

Manifold Pressure (Gas Engines Only)

a. Install pressure fitting on intake manifold. Parts and locations to be determined for each installation.

b. Connect tubing to fitting, route through firewall and connect to fitting on Signal Conditioning Box.

c. Install jumper wires on Signal Conditioning Box.



1. Signal conditioning module
2. Data Logger
3. Support Legs
4. Equipment Table

Figure F-1 Schematic of Equipment Installation

Rail Pressure (Cummins Diesel Engines)

a. Mount pressure transducer with extension hose at convenient location in engine compartment. Remove flex hose from fuel pump outlet and install tee fitting. Connect flex hose and transducer hose to tee fittings. Start engine and check for leaks.

b. Connect cables from transducer to data acquisition system.

Rack Position (Detroit Diesel Engines)

a. Remove rocker cover from engine and install bracket on rack shaft. Reinstall cover.

b. Mount position transducer on bracket in line with rack movement and connect to bracket.

c. Connect cables from transducer to data acquisition system.

Engine RPM (Gas Engine only)

Connect black lead of Cable No. 3A from Data System Terminals 3 and 4 to battery side of the ignition coil. Connect white lead to ground near coil.

Engine RPM - Magnetic Pickup (Diesel Engines only)

Install bracket in front of engine to mount magnetic pickup adjacent to fan blade. Set pickup to approximately 1/8-inch clearance from blade. Connect Cable No. 3A from Data System Terminals 3 and 4 to pickup. Set internal switch for diesel engines.

Engine RPM Transducer (Diesel Engines Only)

In vehicles with a mechanical tachometer, install speed transducer in tach cable drive line as described for vehicle speed above.

Throttle Valve Closure Switch

Install bracket switch on engine so that switch is depressed when idle screw is in slow idle position.

Engine Temperature

Secure thermistor assembly to engine side of water pump housing.

APPENDIX G

METRODATA POWER SUPPLY FAILURE ANALYSIS AND MODIFICATION

In the actual field operation of the Metrodata Data Logger, the series transistor, Q103 in the power supply, and the fuse often failed. See Metrodata Systems, Inc. drawing C-1945, Figure G-1. On occasion and in conjunction with these failures, Q104, Q105, and Q106 also failed.

Analysis

Due to the random nature of these faults, their simulation on the bench was not possible. Therefore, a certain amount of logical speculation was required. The speculations and solutions are below:

1. When only Q103 and the fuse are blown, it is obvious that the 12 VDC RUN ONLY line is short-circuited. As no other damage is present, it is logical to speculate that a circuit, under certain conditions, is intended to short-circuit this line temporarily without damaging itself. Only one such circuit was found (SCR, CR104), in the logic diagram, Metrodata Systems, Inc. drawing 1005B-TB/PWR, Figure G-2. When there is a heavy transient on the 12V RUN ONLY line, this SCR may conduct and exhibit the symptoms mentioned above.
2. Under normal running conditions, the bias voltages of chopper transistors Q101, Q102, Q105,

and Q106 do not exceed ± 5 volts. But, under transient conditions, these voltages exceed ± 5 volts, short-circuiting these transistors. The emitter-bias breakdown voltage of these transistors is rated at ± 5 volts. If Q106 or Q102 are short-circuited, they short-circuit the 12V RUN ONLY line burning the fuse and Q103 in the process. See Metrodata Systems,Inc. drawing 2670 (Figure G-3).

3. In Logger S/N 185, the capacitor C102 was not making good contact. Thus, it failed to reduce transient. It is rated at + 10 VDC although the working voltage is + 12 VDC.

Two possible transient sources have been found. The chopper oscillators are throwing transient on the line and the DC motor can cause transients under certain conditions. A transient may also be induced onto the line from an external radiated source.

Modifications

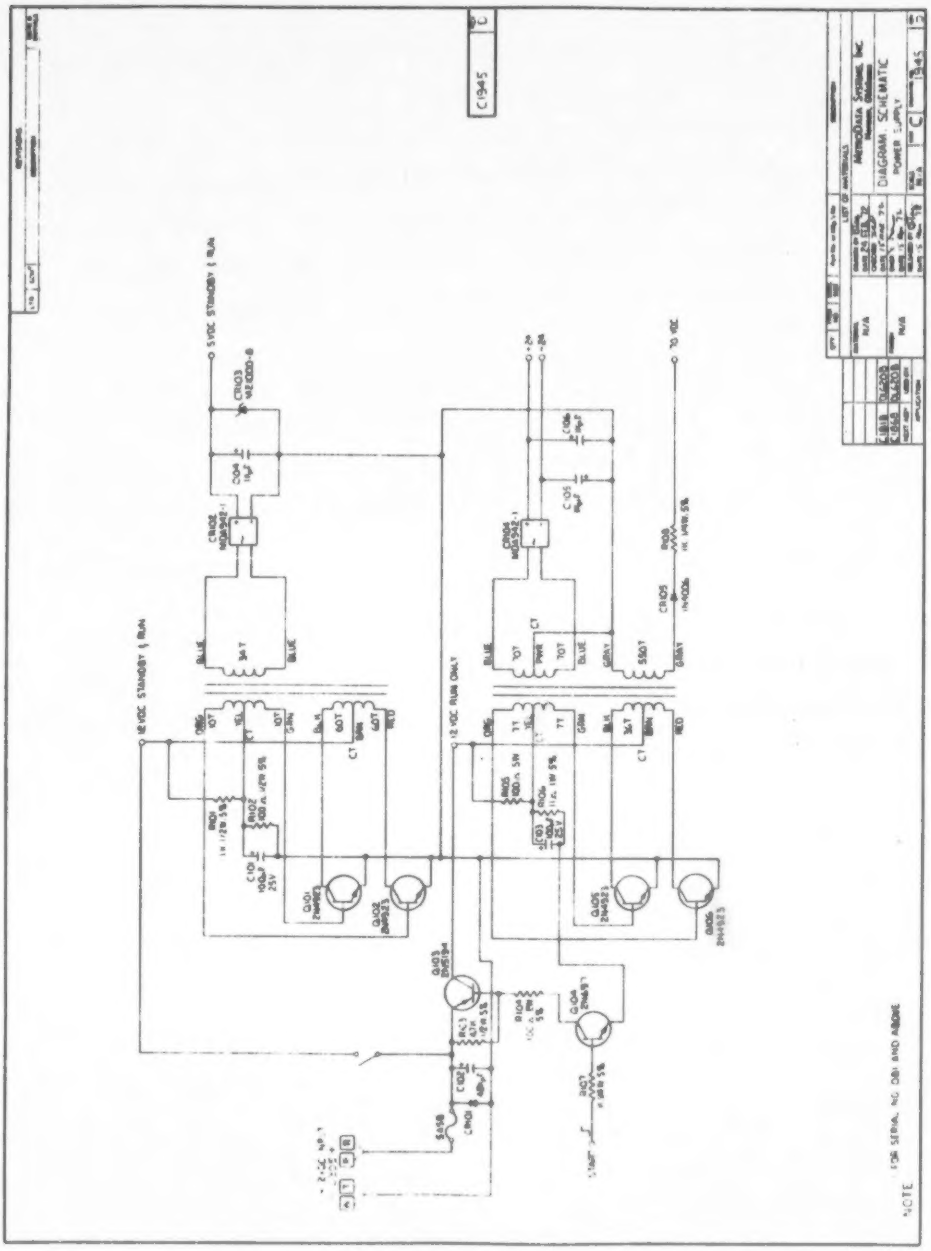
The modifications in the power supply circuit are listed below:

1. The diodes were connected as shown in Figure G-4 at the base of Q101, Q102, Q105 and Q106 to protect the base of those transistors from excessive negative voltage. This change does not impede the normal working of the oscillators.
2. Instead of the SCR anode being connected to the +12 VDC RUN ONLY line, it was connected to the +12 VDC STANDBY and RUN line. In the event of SCR firing, only the fuse will burn.

3. A diode was connected across the motor to suppress any negative transient.
4. A low-inductive 1μF, 35V capacitor was connected across the 48 KμF capacitor to suppress high-frequency spikes. A washer was inserted in the junction of 48 KμF capacitor and the printed circuit board to make a good contact (see diagram).
5. A capacitor of 0.1μF was connected across R 113 (See motor control logic diagram). This will reduce any voltage fluctuation in the motor-drive voltage which in turn will reduce transients.

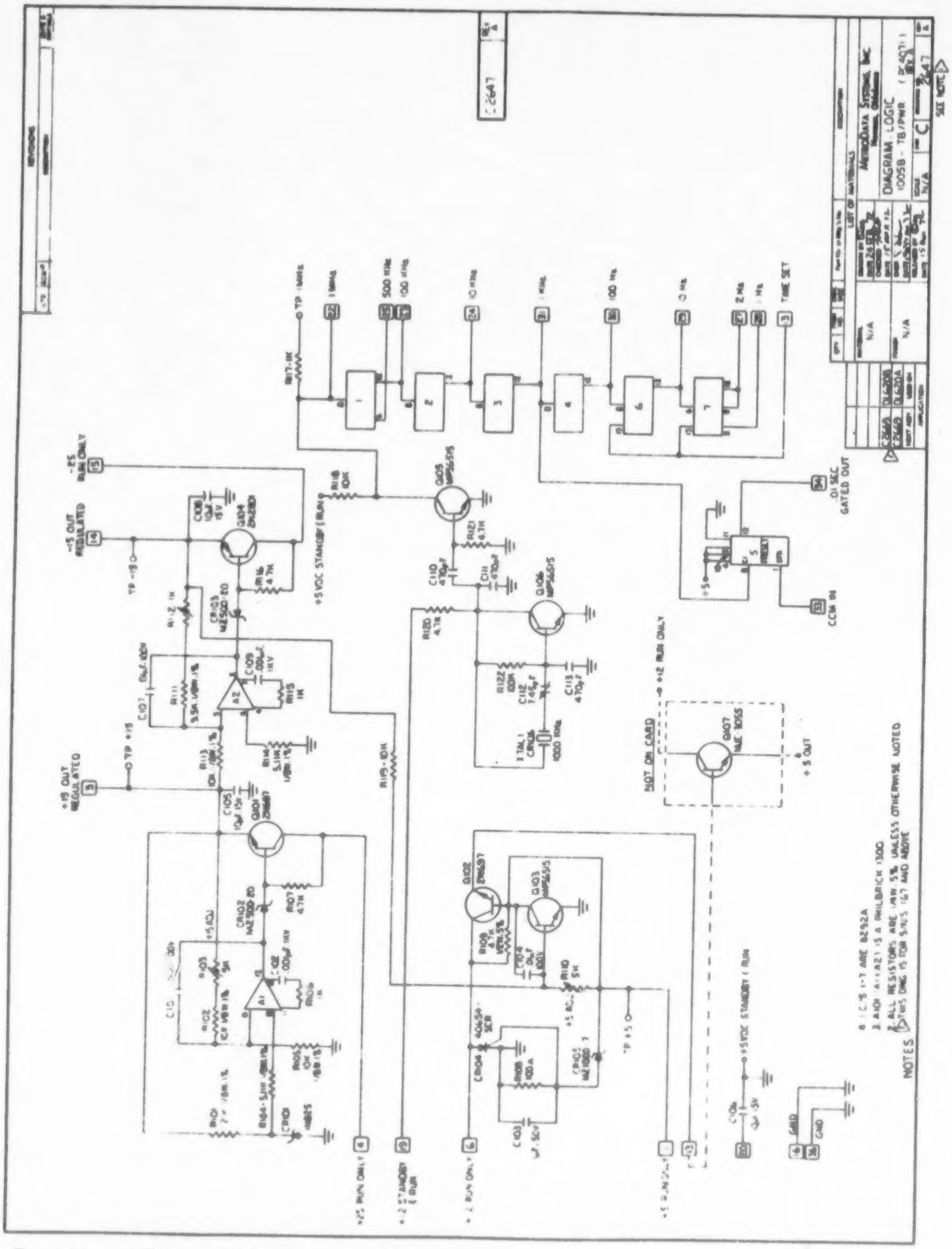
CONCLUSION:

These changes eliminated the power supply problems. As these were speculative investigations, the modified power supplies should be observed for a long period to ensure correctness of speculations.


C1945
MetroData Systems, Inc.
DIAGRAM, SCHEMATIC
POWER SUPPLY
C
1945
12 VDC STANDBY & RUN
5 VDC STANDBY & RUN
12 VDC RUN ONLY
+24
-24
70 VDC
START
NOTE
FOR SERIAL NO. 081 AND ABOVE

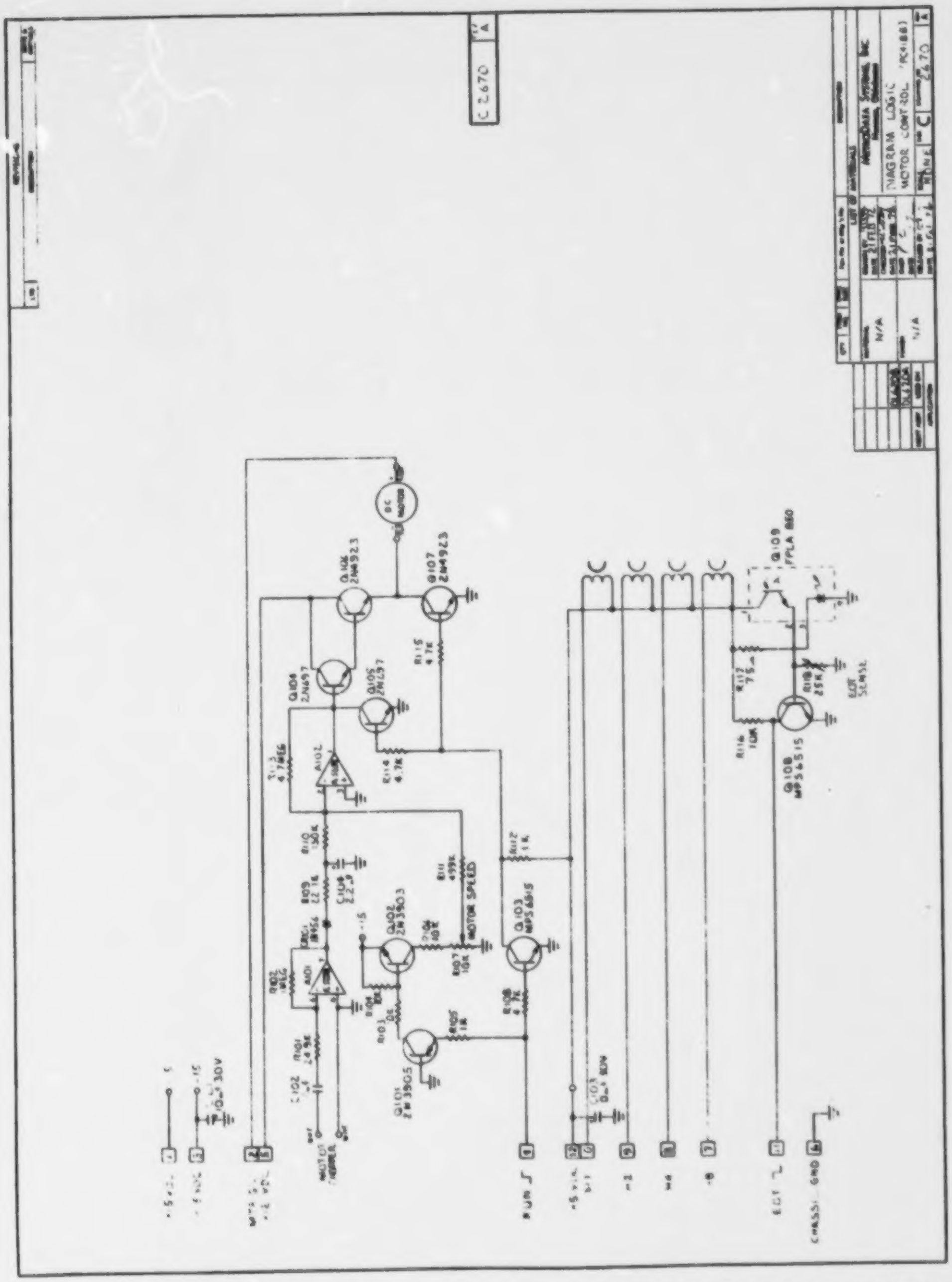
Source: "Operation and Maintenance Manual for the DL620A and DL620B Data Logger and Accessories", Metrodata Systems, Inc. MM2700-01 dated 20 March 1972.

Figure G-1


DIAGRAM, LOGIC
1005B - TB/PWR
METRODATA SYSTEMS, INC.
C2647
TIME SET
CCM IN
.01 SEC GATED OUT
+5 OUT REGULATED
+15 OUT REGULATED
-ES RUN ONLY
+5 VDC STANDBY & RUN
NOT ON CARD
+5 OUT
1 MHz
500 KHz
100 KHz
10 KHz
1 KHz
100 Hz
10 Hz
2 Hz
1 Hz
XTAL 1
1000 KHz
NOTES
ALL RESISTORS ARE 1/4W 5% UNLESS OTHERWISE NOTED
THIS DWG IS FOR S/N'S 167 AND ABOVE

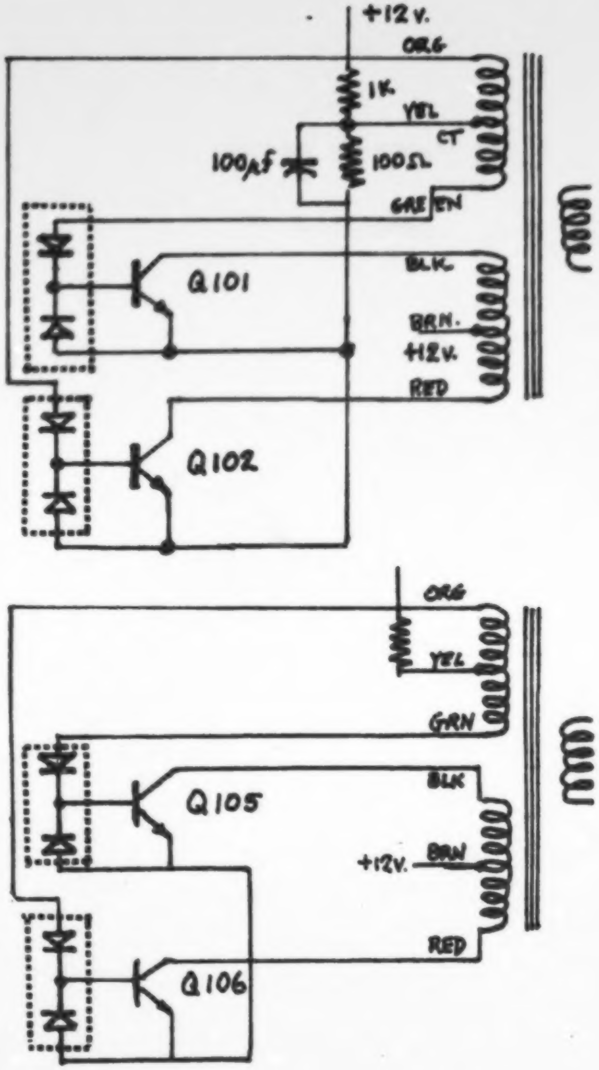
Source: "Operation and Maintenance Manual for the DL620A and DL620B Data Logger and Accessories", Metrodata Systems, Inc. MM2700-01 dated 20 March 1972.

Figure G-2

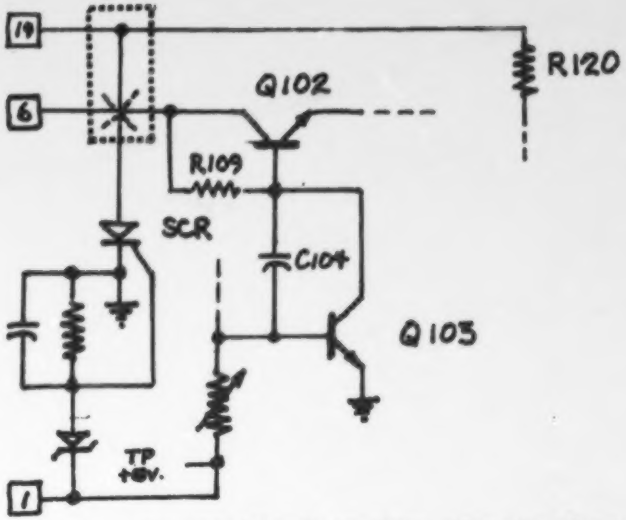

C 2670
METRODATA SYSTEMS, INC.
DIAGRAM LOGIC
MOTOR CONTROL (K4188)
C
2670
N/A
DL620A
DL620B
DC MOTOR
Q106 2N4923
Q107 2N4923
Q104 2N697
Q105 2N697
Q102 2N3903
Q103 MPS6515
Q101 2N3905
Q108 MPS6515
Q109 FPLA 850
A101
A102
MOTOR SPEED
EOT SENSE
RUN
CHASSIS GND

Source: "Operation and Maintenance Manual for the DL620A and DL620B Data logger and Accessories", Metrodata Systems, Inc. MM2700-01 dated March 20, 1972.

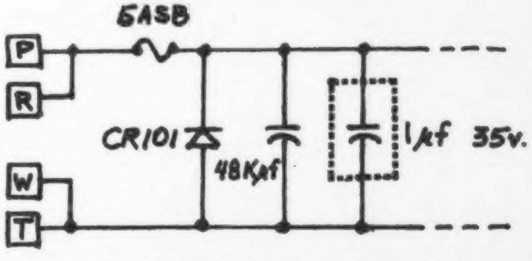
Figure G-3


+12V.
ORG
1K
YEL
CT
100µf
100Ω
GREEN
BLK.
BRN.
+12V.
RED
Q101
Q102
ORG
YEL
GRN
BLK
BRN
+12V.
RED
Q105
Q106

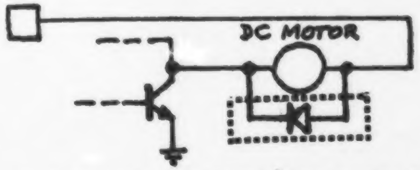
POWER SUPPLY
MODIFICATION
DIODES IN SHADED BOXES ADDED
1N4005


19
6
1
R120
Q102
R109
SCR
C104
Q103
TP
+8V.

CHANGE ANODE OF SCR FROM PIN 6 TO PIN 19
(FROM +12V RUN ONLY TO +12V STANDBY & RUN)


5ASB
P
R
W
T
CR101
48Kµf
1µf 35v.

ADD CAPACITOR ACROSS LINE



ADD DIODE (IN4005) ACROSS DC MOTOR
(MOTOR CONTROL BOARD)

Figure G-4

Appendix H

SURVEY FIELD OPERATIONS

During survey operations, the observer kept an Operation Log and during the 1975 field operations, also maintained a Origin-Destination Log. The Operation Log was primarily used to monitor the operation of the instrumentation at intervals of approximately each 1/2 hour. These data were then checked by a technician to determine if the equipment appeared to be functioning properly, and to assist in locating instrument failures should this be required. The logged information was taken in accordance with the instructions given in Table H-1 and recorded on the form shown in Figure H-1.

The form for the Origin-Destination Log is given in Figure H-2 in accordance with the instructions given on the reverse side of this log. Summary of O-D data is given in Table H-2.

Table H-1

TRUCK DRIVING PATTERN AND USE SURVEY
Phase II

Wilbur Smith and Associates

OPERATION LOG

EQUIPMENT CHECK-OUT

Perform a system checkout before departure. Refer to illustration on reverse side for explanation of symbol and item numbers used in these instructions. DO NOT MOVE ANY SWITCHES OR CONTROLS OTHER THAN THOSE SPECIFIED BELOW.

1. Power - Turn POWER/OFF switch (item 1) to "POWER". Observe that indicator POWER (item 2) is on. Press MODE TEST switch (item 3) and observe that lights behind mode switch (item 4) come on. If no light comes on, press POWER ON switch (item 5). The mode switch permits the selection of mode of operation of the instrumentation. Select "REC" (record) on item 4 and the system displays (item 6) should indicate the values of inputs to the channel selected on the CHANNEL SELECT thumbswitches (item 7).

2. Truck Number - Dial into the space marked DAYS of the date-time input (item 6) the truck number obtained from the log by operating the thumbswitches.

3. Time Set - Dial local time on 24-hour clock basis into HOURS and MINUTES thumbswitches (item 8). At the minute "mark", press TIME SET button (item 9) to initiate clock. Truck number and time is then displayed in item 6 when channels "01" and "02" are selected by thumbswitches (item 7).

    Example 1:

    The truck number (54) is entered into DAYS switches.

    If local time is 7:53 a.m., then enter "07" in HOURS switches and "54" into MINUTES switches. When 7:54 occurs, press TIME SET button. In CHANNEL SELECT switch, select channel "01". Read item 6 display, which should indicate "540" (truck number is 54). Select channel "02". Read item 6 display, which should indicate "754".

    Example 2:

    Enter truck number as in example 1.

    If local time is 2:36 p.m., on a 24-hour clock it is 1436 (1200 + 0236). Enter "14" in HOURS switches and "37" in MINUTES switches. When 2:37 arrives operate TIME SET buttom. Select channel "01" in item 7 and read "541" on item 6 display. Select channel "02" in item 7 and read "437" on item 6 display.

4. Road Type - Road type is indicated by the observer by having one of the three buttons, FREE, ART or LOC (item 10) operated at all times watching the facility be used. To test these inputs, select channel "06" on item 7. Operate the switches of item 10 and observe display (item 6) as follows:

    FREE, display should read from "870" to "930". The SIGN light (item 11) should be "on" indicating a negative value (-900 ± 30).

    ART, display should be from "000" to "030". The SIGN light may be either "on" or "off". (0±30)

    LOC, the display should read from "870" to "930". The SIGN should be "off". (+900 ± 30).

5. Traffic - The operation of one of the switches in item 12 indicates traffic conditions that prevail. Observer is to maintain one of these switches in operation at all times truck is moving. To check the operation of this input, operate LT (Free Flow), MED (Restricted), and HVY (Congested) in sequence and observe display (item 6) as follows:

   LT. the display should read "-900" (-900 ± 30) (see above example).
   MED. the display should read "000" (0 ± 30) (see above example).
   HVY. the display should read "+900" (+900 ± 30) (see above example).

6. Standby - If a survey is to be taken shortly, place the mode selection switch (item 4) to the STBY position. Otherwise, turn the equipment off by operating main power switch (item 1) to OFF.

Report any tests performed which do not agree with the above procedures to the WYLE Instrumentation Director, telephone No. or the WSA Survey Dirctor, telephone No. at once.

B. SURVEY OPERATIONS

The observer has two types of actions to perform during a survey trip. One is to enter into the data certain information as soon as a change occurs. The other is to perform periodic data observations to determine if the equipment is operating satisfactorily. Both will require careful judgement on the part of the observer.

Changing data is primarily the update of switches which indicate ROAD TYPE and TRAFFIC CONDITIONS. These require the proper operation during the survey of input switches (items 10 and 12). Definitions of these conditions are given in the NOTES at the end of this instruction. Under certain conditions, percent load barametric altitude and other data must be noted in the log (Form 120210-2 or 120210-3) manually and at appropriate times.

1. Begin Operation - When the vehicle driver prepares to start the engine, make sure that the equipment checkout has been performed. Check to see that the equipment is on and operating. Check Item 4 to see that it is in the REC position.

The following routine observations shall be made and results either entered into data sheets or instrumentation as follows:

INSTRUMENTATION

1. Road Type - Enter road type being used by proper operation of road type switches (item 10). Definitions are given in notes below. It is important that these switches be changed as soon as road type is changed so that time of change and other data is properly recorded and related.

2. Traffic Condition - Enter traffic condition by proper operation of traffic condition switches (item 12). Definitions are given in notes below. It is likewise important that these switches be changed as soon as the condition changes so that time of change and other data is properly recorded and related.

MANUAL LOG

The following additional data is manually entered into a hand written log (Form 120210-2 or Form 120210-3, as indicated).

Whenever load is picked up or discharged, enter this in Form 120210-2 as follows:

1. Purpose - Indicate this entry as a variable entry by checking column A under PURPOSE.

2. Time - Read and enter instrument time in TIME column by alternately selecting channels "01" and "02" (item 7) and enter display read-out (item 6) in TIME column.

3. Visible Load - Estimate the percent visible load and enter it at the beginning of each trip. If no load is carried put "zero". This factor is based upon the relative volume taken by the load to the volume capacity of the vehicle. Observe this personally. Do not depend upon or ask driver for this information.

Leave other columns blank except COMMENTS column may be used for other notes or observations.

In Los Angeles Only

Changes in barametric altitude may require later adjustments to certain data being recorded. The observer will be supplied an altimeter and should enter changes noted in altitude that exceed 500 foot levels. These observations should be recorded on data sheet 120210-3, as follows:

1. Time - Select alternately channels "01" and "02" when a change of altitude of 500 feet is observed. Enter time in appropriate column.
2. Altitude - From the altimeter, obtain altitude reading and enter data in appropriate column.
3. Comments - In this column, enter any additional remarks concerning these data.

ROUTINE CHECK

Periodic checks are performed to verify proper equipment operation. This requires the performance of a routine series of observations and entering the results on a log (Form 120210-2) manually as described below. These checks should be performed approximately every 1 hour to indicate proper instrument operation.

1. Purpose - Indicate this entry as a routine check by checking Column B under PURPOSE.

2. Time - Select channels "01" and "02" (item 7) in sequence. Enter time displayed (item 6) in appropriate column.

3. Engine RPM - Select channel "03" (item 7). Enter engine displayed (item 6). Place check ( ) in column if this reading agrees with the engine operation.

4. Engine Power - Select channel "04" (item 7). Enter engine power displayed (item 6). Place check ( ) in column if this reading agrees with engine operation (decreases when engine is accelerated).

5. Vehicle Speed - Select channel "05" (item 7). Enter traffic condition displayed (item 6). Place check ( ) in column if this agrees with button selected (item 12).

6. Road Type - Select channel "06" (item 7). Enter road type displayed (item 6). Place check ( ) in column if this agrees with button selected (item 12).

Figure H-2

[illegible]

TRUCK DRIVING PATTERN AND USE SURVEY
PHASE II
OPERATION SURVEY DATA LOG

Date ____________
Truck No. ____________
License No. ____________
Observer ____________

PURPOSE		TIME (Channel)		PER CENT VISIBLE LOAD	ENGINE RPM (Ch 3) R O	ENGINE POWER (Ch 4) R O	VEHICLE SPEED (Ch 5) R O	ROAD TYPE (Ch 6) R O	TRAFFIC (Ch 7) R O	VALVE (Ch 8) R O	ENGINE TEMP (Ch 9) R O	COMMENTS
A	B	:	.									

7. Traffic Condition - Select channel "07" (item 7). Enter traffic condition displayed (item 6). Place check ( ) in column if this agrees with button selected (item 10).

8. Valve - Select channel "08" (item 7). Enter idle stop read out (item 6). Reading should be about "+860" when engine first started and at idle. After engine has warmed up and when accelerating, reading should be about "000".

9. Engine Temp. - Select channel "09" (item 7). Enter engine temperature (item 6). Reading should decrease as engine heats up.

10. Comments - Enter comments concerning data in the column.

Report any improper readings or operation to the WYLE Instrumentation Director, telephone No. or WSA Survey Director, telephone No. at the earliest opportunity.

NOTES: DEFINITIONS

1. ROAD TYPE

FREEWAY - Facilities with medians and multi-lane pavements with controlled access typified by on- and off-ramps, grade separations and no traffic control signals.

ARTERIALS - Facilities with three or more lanes with traffic provided priority flow (few or no STOP signs) and capacity to carry high volume of traffic.

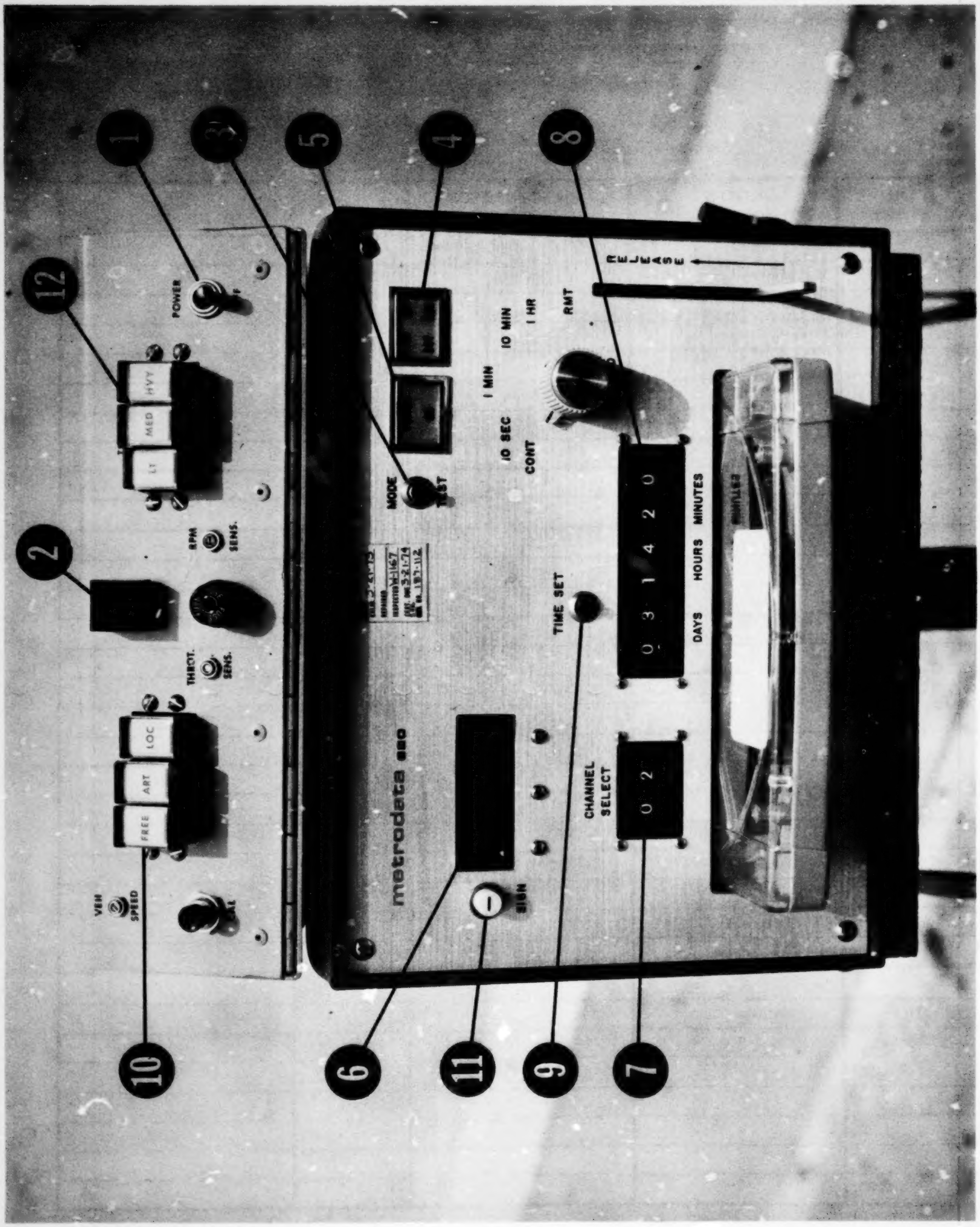
LOCAL STREETS - Facilities general hot included above, but typified by frequent STOP signs at intersections, low capacity design, slow speed limits and less than 3 lanes of traffic.

2. TRAFFIC FLOW

FREE - Traffic flow where speeds are controlled by driver choice and desires, speed limits and physical roadway conditions. Speeds are relatively unaffected by presence of other vehicles.

STABLE - Traffic flow where speeds are restricted by vehicles ahead and alongside vehicle being scored; however, number of vehicles permit satisfactory progress even though they somewhat restrict free choice of lane and of speed.

CONGESTED - Traffic flow characterized by low driver comfort, slow speeds with frequent stops and at times moderate queues of vehicles formed along route.


1
2
3
4
5
6
7
8
9
10
11
12
POWER
LT
MED
HVY
RPM
SENS.
THROT.
SENS.
FREE
ART
LOC
VEH
SPEED
metrodata
MODE
TEST
10 SEC
CONT
1 MIN
10 MIN
1 HR
RMT
RELEASE
TIME SET
0 3 1 4 2 0
DAYS
HOURS
MINUTES
CHANNEL
SELECT
0 2
SIGN

Data Acquisition Controls

TRUCK DRIVING PATTERN AND USE SURVEY - PHASE II

DATE: ___________

ORIGIN DESTINATION LOG

TRUCK NO. ___________

DAY NO. ___________

OBSERVER: ___________

TIME START	ORIGIN DESCRIPTION	DESTINATION DESCRIPTION	TIME END	% VISIBLE LOAD AT ORIGIN

Observer Instructions
ORIGIN DESTINATION LOG

During a truck survey, this log is to be used by the observer to enter the general area in which truck trips start (ORIGIN) and end (DESTINATION), the TIME of each event, and the % VISIBLE LOAD AT ORIGIN.

For these purposes, a truck trip is defined as travel by the vehicle in performing any function regardless of whether delivering goods, services, transporting personnel or whatever.

The ORIGIN and DESTINATION are the location from which the trip began and ended. Enter in this log on the same line the street designations of the nearest intersection to the points where the trip began and ended. For example, enter "6th Ave./48th St." rather than "1212 - 6th Ave.". DO NOT ENTER FIRM NAMES OR ADDRESSES as the description of these data.

In most cases, the DESTINATION of one trip becomes the ORIGIN of the next trip, and should be so entered in the log.

The TIME entries should be obtained from the digital readout of the instrumentation so that the log can be referred directly to the recorded data.

Enter in the column % VISIBLE LOAD AT ORIGIN an estimate of the truck load compared with its capacity. This is a rough indication of the volume occupied by the load to the volume capacity of the truck, according to its body type. For example, if the truck cargo space is one-half full, enter "50%", or quarter-full, "25%".

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 25 - DAY 1			
100	138th St.	0845	41st & 1st Ave.	0950
90	41st & 1st Ave.	1005	5th Ave. & Baybridge Pkwy	1017
80	5th Ave. & Baybridge Pkwy	1026	86th & 5th Ave.	1031
50	86th St. & 5th Ave.	1046	13th Ave. & 52nd St.	1102
45	13th Ave. & 52nd St.	1138	Nostrand & Skillman	1207
5	Nostrand & Skillman	1256	Bedford & Herkimer	1300
0	Bedford & Herkimer	1405	Sumner & Bainbridge	1417
0	Sumner & Bainbridge	1450	138th St.	1655
	TRUCK 25 - DAY 2			
100	132 St.	0815	1st Ave. & 43rd St.	0920
75	1st Ave. & 43rd St.	1050	8th Ave. & 61st St.	1105
50	8th Ave. & 61st St.	1146	New Utrecht & 61st St.	1154
50	New Utrecht & 61st St.	1217	Ave. J. & E 15th St.	1239
45	Ave. J. & E 15th St.	1259	Coney Island & Kings Hwy	1312
30	Coney Island & Kings Hwy	1355	Ave. X & Hubbard St.	1406
25	Ave. X & Hubbard St.	1423	Brighton Ave. & Brighton St.	1431
15	Brighton Ave. & Brighton St.	1451	Shore Pkwy & E. 19th St.	1500
10	Shore Pkwy & E. 19th St.	1525	Nostrand Ave. & Ave. Y.	1534
10	Nostrand Ave. & Ave. Y.	1544	Ave. N & E. 49th St.	1558
	Ave. N. & E. 49th St.	N.R.	132 St.	1830
	TRUCK 25 - DAY 3			
100	132nd St.	0905	Foster Ave. & E. 101st St.	1018
95	Foster Ave. & E. 101st St.	1043	Foster Ave. & E. 99th St.	1047
90	Foster Ave. & E. 99th St.	1106	E. 98th St. & Lavonia	1116
85	E. 98th St. & Lavonia	1129	Foster Ave.	1137
80	Foster Ave.	1208	Ave. I & E. 35th St.	1222
75	Ave. I & E. 35th St.	1226	Ave. N. & E. 49th St.	---
60	Ave. N. & E. 49th St.	1308	Ocean Ave. & Ave. Y	1323
50	Ocean Ave. & Ave. Y	1355	Coney Island Ave. & Ave. Y	1408
40	Coney Island Ave. & Ave. Y.	1442	Neptune Ave. & W. 5th St.	1450
20	Neptune Ave. & W. 5th St.	1549	4th Ave. & Senator St.	1611
0	4th Ave. & Senator St.	1705	132nd St.	1819

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 26 - DAY 3			
100	57 Seabring St.	1955	40th & 2nd	2035
0	40th & 2nd	2119	Front & Dock	2149
0	Front & Dock	2212	Walcott & Ferris	2234
100	Walcott & Ferris	2304	40th & 2nd	2358
0	40th & 2nd	0148	57 Seabring	0220
0	57 Seabring	0236	Walcott & Ferris	0247
100	Walcott & Ferris	0310	40th & 2nd	0408
0	40th & 2nd	0515	57 Seabring	0613
	TRUCK 26 - DAY 4			
100	57 Seabring St.	1945	40th & 2nd	2050
0	40th & 2nd	2145	Walcott & Ferris	2243
100	Walcott & Ferris	2236	40th & 2nd	0035
0	40th & 2nd	0157	Walcott & Ferris	0237
100	Walcott & Ferris	0332	40th & 2nd	0457
0	40th & 2nd	0535	57 Seabring	0633
	TRUCK 26 - DAY 5			
100	57 Seabring	1940	40th & 2nd	2019
0	40th & 2nd	2153	Walcott & Ferris	2228
100	Walcott & Ferris	2328	40th & 2nd	0018
0	40th & 2nd	0204	Walcott & Ferris	0259
100	Walcott & Ferris	0318	40th & 2nd	0416
0	40th & 2nd	0500	57 Seabring	0554
	TRUCK 26 - DAY 6			
100	57 Seabring	1935	40th & 2nd	2021
0	40th & 2nd	2154	Walcott & Ferris	2233
100	Walcott & Ferris	2326	40th & 2nd	0011
0	40th & 2nd	0500	57 Seabring	0553
	TRUCK 26 - DAY 7			
100	57 Seabring St.	1937	40th & 2nd	2108
0	40th & 2nd	2105	Walcott & Ferris	2150
100	Walcott & Ferris	2245	40th & 2nd	2353
0	40th & 2nd	0125	Walcott & Ferris	0207

100	Walcott & Ferris	0313	40th & 2nd	0409
0	40th & 2nd	0515	57 Seabring	0545
% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 27 - DAY 4			
0	Craven & Randall Ave.	0626	Locust Ave. & 139th St.	0635
90	Locust Ave. & 138th St.	0650	East Ave. & 4th	0715
30	East Ave. & 4th	0749	97th & West Ave.	0809
0	97th Ave. & West Ave.	0834	Locust Ave. & 138th St.	0920
90	Locust Ave. & 138th St.	0937	Thieriot & Guerlain	0937
30	Thieriot & Guerlain	1021	161st St. & Prospect	1039
0	161st & Prospect St.	1100	Locust & 138th St.	1117
100	Locust & 138th St.	1135	197th & Grand Concourse	1155
55	197th & Grand Concourse	1222	Field Place	1229
0	Field Place	1300	Craven & Randall	1327
	TRUCK 27 - DAY 5			
0	Craven & Randall Ave.	0605	Locust Ave. & 138th St,	0611
90	Locust Ave. & 138th St.	0624	214th & Broadway	0640
64	214th St. & Broadway	0705	Scarsdale, N.Y.	0704
0	Scarsdale	0804	Anderson & Columbus	0842
91	Anderson & Columbus	0854	190th & Amsterdam	0922
0	190th St, & Amsterdam	0948	188th & St. Nicholas	0951
0	188th & St. Nicholas	1014	Anderson & Columbus	1044
100	Anderson & Columbus	1057	182nd & Aqueduct	1140
51	182nd & Aqueduct	1150	Phelan & Tremont	1155
30	Phelan & Tremont	1214	96th & Columbus	1230
0	96th & Columbus	1300	Craven & Randall	1320
	TRUCK 29 - DAY 5			
100	10th Ave. W. 25th St.	0821	48th Ave. 30 St.	0906
0	48th Ave. 30th St.	1118	10th Ave. & W. 25th St.	1159
100	10th Ave. W. 25th St.	1413	E. 4th Broadway	1435
90	E. 4th Broadway	1443	E. Houston St., Crosby St.	1448
90	E. Houston St., Crosby St.	1457	Crosby St.	1513
25	Crosby St.	1520	E. Houston St., Orchard St.	1559
0	E. Houston, Orchard St.	1613	10th Ave. & W. 25th St.	---

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 29 - DAY 6			
100	10th Ave. W. 25th St.	0810	7th Ave. N. 37th St.	0820
0	7th Ave. E. 37th st.	0837	10 Ave. W. 25th St.	0847
100	10 Ave. W. 25th St.	1215	Frost St. & Adams St.	1250
0	Frost St. & Adams St.	1330	10th Ave. W. 25th St.	1410
100	10th Ave. W. 25th St.	1508	6th Ave. W. 25th St.	1513
80	6th Ave. & W. 25th St.	1528	6th St. 6th Ave.	1623
0	6th Ave. & W. 25th St.	1623	10th Ave. & W. 25th St.	---
	TRUCK 30 - DAY 1			
0	Varwick St.	0825	82nd St., 42nd Ave.	0900
100	82nd St., 42nd Ave.	1109	Varwick St.	1134
	TRUCK 30 - DAY 2			
0	Varwick Ave.	0745	Bridge Plaza 23St.	0807
100	Bridge Plaza 23St.	1029	Thompson & Court St.	1034
0	Thompson & Court	1421	Varwick Ave.	1447
	TRUCK 30 - DAY 3			
100	Varwick Ave.	0820	Court	0848
0	Court	1022	23 St., Bridge Plaza	1035
100	23rd St., Bridge Plaza	1458	Varwick Ave.	1540
	TRUCK 31 - DAY 1			
24	Frost St.	0828	Olive St. & Maspeth St.	0836
24	Olive St. & Maspeth St.	0846	Flushing Ave. & Thames St.	0858
50	Flushing Ave. & Thames St.	0943	Thames St. & Knick Ave.	0953
45	Thames St. & Knick St.	1006	Woosten & Grand St.	1031
80	Woosten & Grand St.	1044	Kent Ave. and N. 5th St.	1200
45	Kent Ave. & N. 5th St.	1246	Grafton St.	1304
45	Grafton St. & Morgon Ave.	1328	Flushing Ave. & Thames St.	1332
50	Flushing Ave. & Thames St.	1344	Weirfield St. Wyckoff Ave.	1352
90	Weirfield St. Wyckoff Ave.	1440	Morgan Ave., STAGG	1450
50	Morgan Ave., STAGG	1521	Flushing Ave., Thames St.	1531

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 31 - DAY 2			
10	Flushing Ave. & Thorne St.	0855	Sea Cliff Ave.	0937
85	Seacliff Ave.	1206	Graftan St. & Knickerboker St.	1301
85	Graftan St. & Knickerboker Ave.	1328	Flushing Ave. & Thames St.	1329
89	Flushing Ave. & Thames St.	1354	Wythe & N. 5th St.	1400
015	Wythe Ave. N. 5th St.	1516	Flushing Ave. & Thomas St.	1538
	TRUCK 31 - DAY 3			
010	Flushing Ave. & Thames St.	0820	College P Blvd., 28th Ave.	0847
030	College P Blvd., 28th Ave.	1010	Flushing Ave. & Thames St.	1040
015	Flushing Ave. & Thames St.	1038	129th St. 15th Ave.	1205
085	129th St. 15th Ave.	1320	Morgan Ave. & Graftan St.	1350
085	Graftan St. & Morgan Ave.	1416	Kent Ave. N. 5th St.	1437
005	Kent Ave. N. 5th St.	0512	Flushing Ave. & Thames St.	1529
	TRUCK 31 - DAY 4			
007	Flushing Ave. & Thames St.	0932	Sea Cliff Ave. & Hazel St.	1016
607	Sea Cliff Ave. & Hazel St.	1121	Kent Ave. N. 5th St.	1205
007	Kent Ave. N. 5th St.	1250	Olive St. & Maspeth Ave.	1300
007	Olive St. & Maspeth Ave.	1306	Flushing Ave. & Thames St.	1315
	TRUCK 31 - DAY 5			
015	Flushing Ave. & Thames St.	0815	St. Nicholas Ave. W. 167th St.	0859
015	St. Nicholas Ave. W. 167th St.	0909	Coolidge Ave. & Overpeck	0925
075	Coolidge Ave. & Overpeck Ave.	1033	Kent Ave. N. 5th St.	1127
015	Kent Ave. N. 5th St.	1220	Flushing Ave. & Thames Ave.	1235
010	Flushing Ave. & Thames St.	1236	Graftan St. & Kinderback Ave.	1246
010	Graftan St. & Kinderback St.	1311	14th Ave. 129th St.	1337
090	14th Ave. 129th St.	1455	Flushing Ave. & Thame St.	1530
	TRUCK 32 - DAY 1			
0	Sebring St. & Van Brunt	1940	Ferris & Walcott	1944
100	Ferris & Walcott	2051	40th St.& 2nd Ave.	2145
0	40th St. & 2nd Ave.	2201	Sebring St. & Van Brunt	2207
0	Sebring St. & Van Brunt	2259	Ferris & Walcott	2310
100	Ferris & Walcott	2326	40th St. & 2nd Ave.	0123

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 32 - DAY 1 (Cont.)			
0	40th St. & 2nd Ave.	0140	Ferris & Walcott	0226
100	Ferris & Walcott	0245	Sebring St. & Van Brunt	0248
	TRUCK 32 - DAY 4			
0	Sebring & Van Brunt	2006	Ferris & Walcott	2044
100	Ferris & Walcott	2102	40th St. & 2nd Ave	2216
0	40th St. & 2nd Ave.	2243	Ferris & Walcott	0100
100	Ferris & Walcott	0121	40th St. & 2nd Ave.	0222
0	40th St. & 2nd Ave.	0245	Ferris & Walcott	0336
100	Ferris & Walcott	0400	40th St. & 2nd Ave.	0515
0	40th St. & 2nd Ave.	0546	Sebring & Van Brunt	0639
	TRUCK 32 - DAY 4			
0	Sebring & Van Brunt	2006	Walcott & Ferris	2022
100	Walcott & Ferris	2047	40th St. & 2nd Ave.	2227
0	40th St. & 2nd Ave.	2255	Walcott & Ferris	0056
100	Walcott & Ferris	0120	40th St. & 2nd Ave.	0240
0	40th St, & 2nd Ave.	0305	Walcott & Ferris	0352
100	Walcott & Ferris	0407	Sebring & Van Brunt	0410
	TRUCK 33 - DAY 1			
0	Albermarle & Nostrand	0750	Grandview & Harmon	0841
90	Grandview & Harmon	1440	Albermarle & Nostrand	1527
	TRUCK 34 - DAY 1			
70	30th St. & 11th Ave.	1110	Henderson & lrst St.	1140
30	Henderson & lrst St.	1202	3oth St. & 11th Ave.	1233
30	30th St. & 11th Ave.	1314	36th St. & 7th Ave.	1339
15	36th St. & 7th Ave.	1346	33rd St. & 9th Ave.	1401
0	33rd St. & 9th Ave.	1418	30th St. & 11th Ave.	1436

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 34 - DAY 2			
0	30th St. & 11th Ave.	0721	Global Terminal	0748
100	Global Terminal	0901	21st St. & 12th St.	0955
0	21st St. 12th Ave.	1035	30th St., 11th Ave.	1100
0	30th St. & 11th Ave.	1147	Global Terminal	1305
0	Global Terminal	1405	30th St., 11th Ave.	1450
	TRUCK 34 - DAY 3			
100	25th St. & 12th Ave.	1150	21st St. & 12 St.	1157
0	21st St. & 12 Ave.	1455	25th St. & 12th Ave.	1509
	TRUCK 34 - DAY 4			
0	30th St.& 12th Ave.	0647	Van Brunt & Sebring	0730
100	Van Brunt & Sebring	0922	Washington & Warren	1000
0	Washington & Warren	1035	Van Brunt & Sebring	1120
100	Van Brunt & Sebring	1337	Washington & Warren	1415
0	Washington & Warren	1515	30th St, & 12th Ave.	1548
	TRUCK 34 - DAY 5			
0	30th St. & 12th Ave.	0620	Port Elizabeth	0718
0	Port Elizabeth	0850	32nd St. & 11 Ave.	1050
50	32nd St. & 11th Ave.	1220	30th St. & 12th Ave.	1227
0	30th St. & 12th Ave.	1232	Sebring & Van Brunt	1315
0	Sebring & Van Brunt	1355	30th St. & 12th Ave.	1445
	TRUCK 35 - DAY 1			
100	75 Frost St.	0825	S. Fulton- 5th St.	1005
75	S. Fulton, 5 St.	1011	N. Ave., Lincoln Ave.	1047
65	N. Ave., Lincoln Ave.	1101	E. Tremont Ave., Maps	1137
60	E. Tremont - Maps	1145	E. Burnside - Ryer Ave.	1202
50	E. Burnside - Ryer Ave.	1226	E. 180st - Clinton Ave.	1225
45	E. 100st - Clinton	1231	Grand - Burnside	1242
35	Grand - Burnside	1259	Jerome - Macombs	1308
25	Jerome - Macombs	1318	Morris Ave. 165th St.	1226

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 35 - DAY 1 Cont.			
15	Morris Ave. 165th St.	1336	125th St., 8th Ave.	1354
10	125th St. 8 Ave.	1406	57th St. 9th AVE.	1422
5	57th St. 9th AVE.	1441	E. 12th 4th AVE.	1500
0	E. 12th, 4th Ave.	1507	76th St. & Jamica Ave.	1547
	TRUCK 35 - DAY 2			
100	76th St. & Jamica	0815	161 Forest Ave.	0935
80	161 St., Forest	0945	Post Ave., Dykman	1011
75	Post Ave., Dykman	1030	St. Nicholas, 162nd St.	1045
70	St. Nicholas, 162nd St.	1057	St. Nicholas, 161 St.	1100
60	St. Nicholas, 161 St.	1113	157th Broadway	1118
50	157th Broadway	1126	150 Broadway	1128
40	150 Broadway	1155	138 Broadway	1158
30	138th Broadway	1219	131 Amsterdam	1223
20	131 Amsterdam	1234	W. 100 Amsterdam	1246
10	W. 100 Amsterdam	1257	W. 68th Broadway	1308
0	W. 68th Broadway	1321	76th St. Jamica	1446
	TRUCK 35 - DAY 3			
100	76th St., Jamica	0815	Fulton, Albany	0906
90	Fulton, Albany	0923	Rodchester, Sterling	0933
50	Rodchester, Sterling	0959	St. Johns, Utica	1003
25	St. Johns, Utica	1036	St. John, Troy	1047
0	St. John, Troy	1050	St. John, Brooklyn	1058
10	St. John, Brooklyn	1106	3rd Ave. 23rd St.	1151
0	3rd Ave. 23rd St.	1233	36th Ave. 3rd Ave.	1240
10	36th St. 3rd Ave.	1249	34th St. 3rd Ave.	1252
100	34th St. 3rd Ave.	1428	76th St. Jamica	1508
	TRUCK 35 - DAY 4			
50	76th St. Jamica	0800	3rd Ave., 104 St.	0928
45	3rd Ave., 104 St.	0940	Broadway, W. 144	1000
40	Braodway, W. 144 St.	1013	Shakespeare, Jacobs	1037
35	Shakespeare, Jacobs	1049	St, Annes, E. 139	1117
30	St. Annes, E. 139	1123	Westchester Ave., West Farm	1135
20	Westchester, West Farms	1144	Fulton, Landon	1207

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 35 - DAY 4 (cont.)			
10	Fulton, Landon	1216	Hunts Point	1249
100	Hunts Point	1425	76th Jamica	1515
	TRUCK 36 - DAY 1			
100	Paidge St, McGuiness	0815	217th St. 58th Ave.	0848
50	217th St., 58th Ave.	1306	219th St., 51st Ave.	1412
25	219th St., 51st Ave.	1430	47th Ave., Springfield	1432
0	47th Ave., Springfield Blvd.	1517	235th St., 40th Ave.	1751
0	235th St. & 40th Ave.	1755	Paidge & McGuinness	1830
	TRUCK 36 - DAY 2			
100	Paidge, Mdg. Blvd.	0630	Doug Laston	0705
314	Doug Laston	1020	43rd St., 22 Ave.	1045
50	43rd St., 22 Ave.	1110	98th St., 63rd St.	1139
0	98th St., 63rd St.	1714	Paidge & Mcquinness	1736
	TRUCK 36 - DAY 3			
100	Paidge, McGuinness	0645	97th & 63rd St,	0739
50	97th & 63rd St.	1058	53rd Ave., 156th St.	1111
50	53rd Ave., 156th St.	1259	59th St. Grand Ave.	1323
25	59th St. Grand Ave.	1341	64th St., Madison St.	1400
0	64th St., Madison St.	1418	Paidge & McGuinness	1800
	TRUCK 37 - DAY 1			
100	Maspeth Ave. & Vandervoort St.	0645	Warren & Columbia St.	0725
0	Warren & Columbia St.	0815	Maspeth Ave. & Vanderwoort St.	0832
100	Maspeth & Vandervoort	0857	Troutman St. & Central Ave.	0908
45	Troutman St. & Central Ave.	0945	Metropolitan St. & 61rst St.	1013
07	Metropolitan St. & 61st St.	1051	Maspeth Ave. & Vandervoort St.	1100
100	Maspeth Ave. & Vandervoort	1209	E, 4th St. & Bowery St.	1240
0	E. 4th St. Bowery	1350	Maspeth & Vandervoort	1413
100	Maspeth & Vandervoort	1446	Boston Rd. & Pelhon Pkwy	1530
0	Boston Rd. & Pelhon Pkwy	1639	Maspeth & Vandervoort	1745

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 37 - DAY 2			
100	Maspeth Ave. & Vandvoort St.	0648	Kissena Blvd. & 65 Ave.	0720
0	Kissena Blvd. & 65th Ave.	0825	Maspeth Ave. & Vandervoort St.	0855
100	Maspeth Ave. & Vandervoort	0926	35th St., 45th Ave.	0944
100	35th St., 45th Ave.	0958	Roosevelt Ave. & 88th St.	1023
17	Roosevelt Ave. & 88th St.	1100	49th St. & 50th Ave.	1118
3	49th St. & 50th Ave.	1136	Maspeth Ave. & Vandervoort St.	1146
100	Maspeth Ave. & Vandervoort	1240	Columbia St. & Warren St.	1258
7	Columbia St. & Warren St.	1347	Maspeth Ave. & Vandervoort	1402
100	Maspeth St. & Vandervoort	1430	Conduit Blvd., 153rd St.	1502
0	Conduit Blvd., 153rd	1541	Maspeth Ave. & Vandervoort	1410
	TRUCK 38 - DAY 1			
40	233rd & Dyre Ave.	0243	196th & Lexington	0307
36	196th & Lexington	0314	86th & 2nd Ave.	0321
33	86th & 2nd Ave.	0348	84th & 2nd Ave.	0351
45	84th & 2nd Ave.	0436	76th & 2nd AVE	0440
44	76th & 2nd Ave.	0442	81rst & East End	0446
44	81rst & East End	0447	79th & 2nd Ave.	0451
44	79th & 2nd Ave.	0453	80th & Lexington	0454
43	80th & Lexington	0459	81rst & Lexington	0501
42	81rst & Lexington	0506	82nd & 2nd Ave	0507
42	82nd & 2nd Ave.	0512	79th & 2nd Ave.	0522
40	79th & 2nd Ave.	0529	72nd & 2nd Ave.	0532
40	72nd & 2nd Ave.	0536	66th & 2nd Ave.	0539
39	66th & 2nd Ave.	0543	56th & Lexington	0546
39	56th & Lexington	0548	58th & 1st Ave.	0556
38	58th & 1st Ave.	0556	68th & 1st Ave.	0557
38	68th & 1st Ave.	0616	80th & 1st Ave.	0618
	80th & 1st Ave.	0628	81st & 1st Ave.	0626
	81st & 1st Ave.	0636	82nd & 1st Ave.	0642
	61st & 1st Ave.	0651	73rd & 1st Ave.	0658
	73rd & 1st Ave.	0703	74th & 1st Ave.	0703
	74th & 1st Ave.	0715	79th & 1st Ave.	0716
	79th & 1st Ave.	0720	72 & 2nd Ave.	0722
	76th & 2nd Ave.	0726	75th & 2nd Ave.	0726
	75th & 2nd Ave.	0733	89th & 2nd Ave.	0821
	87th & 2nd Ave.	71st	71st & 2nd	0827

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 38 - DAY 1 (Cont.)			
*			85th & 1st St.	1045
	88th & 1st Ave.	1049	87th & 1st St.	1115
	82nd & 1st Ave.	1134	83rd & 1st St.	1134
	83rd & 1st St.	1338	84th & Lexington	1142
	84th & Lexington	1200	233rd & Dyre	1225

*OPERATED IN SAME AREA

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 38 - DAY 2			
20	233rd & Dyre	0235	96th & Lexington	0258
18	96th & Lexington	0310	83rd & 1st Ave.	0317
18	83rd & 1st Ave.	0318	84th & 2nd Ave.	0320
15	84th & 2nd Ave.	0387	84th & 2nd Ave.	0400
65	84th & 2nd Ave.	0428	78th 3rd Ave.	0431
63	78th 3rd Ave.	0448	83rd & 3rd Ave.	0453
65	83rd & 3rd Ave.	0455	83rd & 2nd Ave.	0458
65	83rd & 2nd Ave.	0501	73rd & 2nd Ave.	0503
62	73rd & 2nd Ave.	0510	69th & 2nd Ave.	0512
61	67th & 2nd Ave.	0517	65th & 2nd Ave.	0519
61	65th & 2nd Ave.	0521	58th & 1st Ave.	0523
60	58th & 1st Ave.	0528	64th & 1st Ave.	0529
60	64th & 1st Ave.	0533	68th & 1st Ave.	0533
58	68th & 1st Ave.	0542	79th & 1st. Ave.	0544
58	79th & 1st Ave.	0552	82nd & 3rd Ave.	0554
	82nd & 3rd Ave.	0600	81st & 2nd Ave.	0600
50	81st & 2nd Ave.	0620	67th & 1st Ave.	0628
45	67th & 1st Ave.	0637	69th & 1st Ave.	0640
45	69th & 1st Ave.	0648	74th & 1st Ave.	0649
35	74th & 1st Ave.	0800	88th & Lexington	0809
32	88th & Lexington	0824	86th & Lexington	0824
35	84th & Lexington	0900	86th & 1st Ave.	0906
30	86th & 1st Ave.	0923	82nd & 1st Ave.	0932
30	82nd & 1st Ave.	0956	2nd St.	0932
26	73rd & 1st Ave.	1301	82nd & 1st Ave.	1306
8	82nd & 1st Ave.	1313	233 & Dyre	1306
7	81st and 1st St.	1212	-	-

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 38 - DAY 4			
10	233rd & Dyre	0312	96th & Lexington	0332
9	96th & Lexington	0339	84th & 2nd	0343
5	84th & 2nd	0535	84th & 2nd	0356
50	84th & 2nd	0444	83rd & 2nd	0445
60	83rd & 2nd	0450	80th & 3rd	0454
504	80th & 3rd	0455	78th & 2nd	0501
48	78th & 2nd	0512	79th & 3rd	0514
47	79th & 3rd	0517	82nd & 3rd	0519
47	82nd & 3rd	0525	72nd & 2nd	0528
46	72nd & 2nd	0532	66th & 3rd	0535
46	66th & 3rd	0536	58th & 1st	0539
46	58th & 1st	0542	64th & 1st	0544
45	64th & 1st	0545	64th & 1st	0550
44	64th & 1st	0554	80th & 1st	0557
43	80th & 1st	0604	81st & 2nd	0606
42	81st & 2nd	0615	75th & 2nd	0618
42	75th & 2nd	0626	76th & 3rd	0628
41	76th & 3rd	0633	65th & 2nd	0636
40	65th & 2nd	0638	62nd & 2nd	0640
39	62nd & 2nd	0650	69th & 1st	0654
39	69th & 1st	0651	73rd & 1st	0657
38	73rd & 1st	0707	74th & 1st	0709
37	74th & 1st	0711	79th & 1st	0716
36	79th & 1st	0719	76th & 2nd	0721
36	76th & 2nd	0775	84th & 1st	0780
35	84th & 1st	0741	85th & York	0742
35	85th & York	0745	86th & 1st	0747
34	86th & 1st	0749	85th & 2nd	0751
34	85th & 2nd	0758	86th & 3rd	0755
33	86th & 3rd	0759	88th & Lexington	0801
32	88th & Lexington	0815	86th & Lexington	0815
--	86th & Lexington	0830	82nd & 2nd	0836
--	82nd & 2nd	0841	56th & Lexington	0854
	TRUCK 38 - DAY 5			
20	233rd & Dyre	0250	96th & Lexington	0313

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 38 - DAY 5			
29	96th & Lexington	0321	84th & 2nd	0325
55	84th & 2nd	0442	83rd & York	0448
55	83rd & York	0450	85th & East End	0452
54	84th & East End	0453	76th & 2nd	0457
53	76th & 2nd	0458	78th & 2nd	0502
53	78th & 2nd	0513	79th & 3rd	0516
52	79th & 3rd	0518	81st & 3rd	0520
52	81st & 3rd	0528	83rd & 3rd	0531
51	83rd & 2nd	0534	81st & 3rd	0535
50	81st & 3rd	0057	73rd & 2nd	0543
50	73rd & 2nd	0601	58th & 1st	0605
49	58th & 1st	0609	69th & 1st	0611
44	74th & 1st	0616	79th & 2nd	0622
44	79th & 2nd	0628	81st & 1st	0630
43	81st & 1st	0635	76th & 2nd	0657
42	76th & 2nd	0639	65th & 2nd	0641
42	65th & 2nd	0645	69th & 1st	0667
40	69th & 1st	0707	73rd & 1st	0708
39	73rd & 1st	0726	75th & 1st	0730
38	78th & 1st	0734	79th & 1st	0734
37	79th & 1st	0738	74th & 2nd	0742
36	74th & 2nd	0753	86th & 3rd	0758
35	86th & 3rd	0803	88th & Lexington	0810
35	88th & Lexington	0824	86th & Lexington	0825
34	86th & Lexington	0839	86th & 2nd	0865
33	86th & 2nd	0846	78th & 2nd	0848
32	78th & 2nd	0901	71st & 2nd	0904
25	71st & 2nd	0925	66th & 1st	0927
25	66th & 1st	0942	73rd & 1st	0942
23	73rd & 1st	0950	82nd & 1st	0982
21	82nd & 1st	1015	East End & 83rd	1017
20	East End & 83rd	1028	84th & York	1031
	TRUCK 39 - DAY 2			
0	25th St. & 11th Ave.	0851	25th St. & 11th Ave.	0854
100	25th St. & 11th Ave.	1042	21st St. & 11th Ave.	1052
0	21st St. & 11th Ave.	1156	25th St. & 11th Ave.	1201
100	25th St. & 11th Ave.	1524	21st St. & 11th Ave.	1539

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 39 - DAY 4			
100	25th St. & 11th Ave.	1302	21st St. & 11th Ave.	1314
0	21st St. & 11th Ave.	1518	25th St. & 11th Ave.	1530
	TRUCK 39 - DAY 5			
100	25th St. & 11th Ave.	1045	21st St. & 11th Ave.	1051
0	21st St. & 11th Ave.	1217	25th St. & 11th Ave.	1224
100	25th St. & 11th Ave.	1518	21st St. & 11th Ave.	1532
0	21st St. & 11th Ave.	1720	25th St. & 11th Ave.	1732
	TRUCK 39 - DAY 6			
100	25th St. & 11th Ave.	1044	21st St. & 11th Ave.	1054
0	21st St. & 11th Ave.	1230	25th St. & 11th Ave.	1238
	TRUCK 42 - DAY 1			
100	130th St. & Northern	1307	20th Ave. & 21st St.	1320
0	2oth Ave. & 21st St.	1410	130th St. & Northern	1425
	TRUCK 42 - DAY 3			
100	130th St. & Northern	0849	W. 31st St. & 9th Ave.	1015
10	W. 31st St. & 9th Ave.	1109	E. 158th St. Courtlandt Ave.	1200
5	E. 158th St. Courtlandt Ave.	1220	8th Ave. E. 160th St.	1235
0	8th Ave. E. 160th St.	1245	20th Ave. 35th St.	1250
100	20th Ave. 35th St.	1550	130th & Northern	1613
	TRUCK 42 - DAY 4			
100	130th St. & Northern	0724	Along Side 3rd East	
0	Along Side 3rd East	1032	31st St. & 20th Ave.	1115
100	31st & 20th Ave.	1345	1st Toll & N.J. Turnpike	1516
0	1st Toll & N.J. Turnpike	1541	130th St. & Northern	1630
	TRUCK 43 - DAY 1			
40	40th & 2nd	0828	22nd & 3rd	0831
0	22nd & 3rd	0840	Pier 1	0858

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 43 - DAY 1			
85	Pier 1	1028	40th & 3rd	1040
40	40th & 3rd	1534	43rd & 1st	1540
50	43rd & 1st	1600	Pier 1	1618
0	Pier 1	1617	Port Newark	1716
100	Port Newark	1736	Pier 1	1843
0	Pier 1	1850	Union Boltic	0856
0	Union Boltic	1929	Port Newark	2010
100	Port Newark	2024	Pier 1	2126
0	Pier 1	2135	43rd St. & 1st	2150
	TRUCK 43 - DAY 2			
100	40th St. & 4th Ave.	1600	Pier 5	1620
0	Pier 5	1632	Pier 1	1643
0	Pier 1	1652	40th St. & 4th Ave.	1718
	TRUCK 43 - DAY 3			
25	40th St. & 3rd Ave.	1030	Pier 2	1051
0	Pier 2	1110	40th St. & 3rd Ave.	1125
100	40th St. & 3rd Ave.	1413	Calcutta & Corbin	1505
100	Calcutta & Corbin	1543	Woodbridge	1656
100	Woodbridge	1710	40th St. & 3rd Ave.	1815
	TRUCK 44 - DAY 1			
80	97th & Lexington	0841	91st & 1st Ave.	0855
80	91st & 1st Ave.	0924	100th & 2nd Ave.	0927
80	100th & 2nd Ave.	0945	116th & 3rd Ave.	0950
80	116th & 3rd Ave.	1342	96th & Lexington	1349
80	96th & Lexington	1358	102nd & 5th Ave.	1400
	TRUCK 44 - DAY 2			
80	97th & Lexington	0848	91st & 3rd Ave.	0852
80	91st & 3rd Ave.	0905	117th & 3rd Ave.	0912
80	117th & 3rd Ave.	1045	97th & 2nd Ave.	1049
80	97th & 2nd Ave.	1102	92nd & 2nd Ave.	1110
80	92nd & 2nd Ave.	1140	97th & Lexington	1150

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 44 - day 2			
80	97th & Lexington	1302	106th & Lexington	1306
80	106th & Lexington	1333	91st & 2nd Ave.	1337
80	91st & 2nd Ave.	1349	121st & 2nd Ave.	1356
80	121st & 2nd Ave.	1557	102nd & Park	1608
	TRUCK 44 - DAY 6			
80	102nd & 8th	0752	97th & Lexington Ave.	0758
80	97th & Lexington Ave.	0843	96th St. & 3rd Ave.	0853
80	96th St. & 3rd Ave.	1138	91st Mad. Ave.	1142
80	91st & Mad. A e.	1157	97th & 3rd Ave.	1201
80	97th & 3rd Ave.	1507	105th St. & 1st Ave.	1504
	105th St. & 1st Ave.	1536	1st Ave. & 112th Ave.	1539
	1st Ave. & 112th Ave.	1608	96th & 3rd Ave.	1617
	96th & 3rd Ave.	1620	102nd & 5th Ave.	1632
	TRUCK 44 - DAY 7			
80	96th & 3rd Ave.	1622	97th St. & Lexington	1624
80	97th & Lexington	1628	102nd & 5th St.	1632
	TRUCK 44 - Day 8			
0	102nd & 5th Ave.	0744	97th & Lexington	0749
0	97th & Lexington	0822	96th & 3rd Ave.	0824
0	96th & 3rd Ave.	1317	102nd & 5th Ave.	1727
	TRUCK 45 - DAY 1			
0	Sebring & Commerce	0803	Ferris & Walcott	0808
100	Ferris & Walcott	0840	Pacific & 6th St.	0924
0	Pacific & 6th St.	0950	Seabring & Van Brunt	1005
0	Seabring & Van Brunt	1020	Ferris & Walcott	1053
100	Ferris & Walcott	1115	Seabring & Van Brunt	1122
100	Seabring & Van Brunt	1244	Pacific & 6th St.	1303
0	Pacific & 6th St.	1402	Seabring & Van Brunt	1419
	TRUCK 45 - DAY 3			
0	Seabring & Van Brunt	0812	Walcott & Ferris	0818

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 45 - DAY 3 (Cont.)			
100	Walcott & Ferris	0830	Pacific & 6th St.	0912
0	Pacific & 6th St.	0938	Walcott & Ferris	1040
100	Walcott & Ferris	1052	Pacific & 6th St.	1137
0	Pacific & 6th St.	1147	Seabring & Van Brunt	1204
0	Seabring & Van Brunt	1328	Walcott & Ferris	1335
100	Walcott & Ferris	1405	Pacific & 6th St.	1445
0	Pacific & 6th St.	1459	Seabring & Van Brunt	1533
	TRUCK 45 - DAY 5			
0	Seabring & Van Brunt	0806	Walcott & Ferris	0810
100	Walcott & Ferris	0837	Pacific & 6th St.	0923
0	Pacific & 6th St.	0950	Seabring & Van Brunt	1005
	TRUCK 48 - DAY 5			
100	Bronx River Pkwy	0830	Webster & 201st St.	0842
100	Webster & 201st St.	1149		
100		1225	Webster & 201st St.	1235
100	Webster & 201st St.	1546	Bronx River Pkwy	1639
	TRUCK 48 - DAY 6			
100	Bronx River Pkwy	0845	Fordam Rd.	0850
100	Fordam Rd.	0930	Webster & 201st St.	0933
100	Webster & 201st St.	1148	Bronx Park E. & Mace	1201
100	Bronx Park E. & Mace	1237	Webster & 201st St.	1243
100	Webster & 201st St.	1554	Bronx River Pkwy	1638
	TRUCK 48 - DAY 7			
100	Bronx River Pkwy	0841	Webster & 201st St.	0841
100	Webster & 201st St.	1152	Fordam Rd.	1157
100	Fordam Rd.	1241	Webster & 201st St.	1249
100	Webster & 201st St.	1608	Bronx River Pkwy	1636
	TRUCK 49 - DAY 1			
0	Frost & Adams	0925	43 Van Brunt	0939

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 49 - DAY 1			
0	43rd Van Brunt St.	1028	1st Ave. & 39th St.	1048
2	1st Ave. & 39th St.	1052	43rd Van Brunt St.	1108
	TRUCK 49 - DAY 3			
2	43rd Van Brunt	0902	42nd St. & 1st Ave.	0930
0	42nd St. & 1st Ave.	0938	43rd Van Brunt	1001
	TRUCK 49 - DAY 4			
7	43rd & Van Brunt St.	1259	1st Ave. & 58th St.	1320
0	1st Ave. & 58th St.	1330	43rd & Van Brunt	1343
	TRUCK 49 - DAY 5			
0	Other Yard	1152	43rd Van Brunt St.	1158
0	43rd Van Brunt St.	1160	Other Yard	1212
100	Other Yard	1324	1st Ave. & 58th St.	1340
0	1st Ave.	1347	Other Yard	1406
	TRUCK 50 - DAY 1			
0	N. Henry St.	0655	College Point & Cross Way	0711
100	College Point & Cross Way	0725	Main St. & 61st St.	0752
92	Main St. & 61st St.	0800	65th Ave. & 165th St.	0812
94	65th Ave. & 165th St.	0818	168th St. & 67th Ave.	0819
89	168th St. & 67th Ave.	0827	65th Ave. & 181st St.	0832
81	65th Ave. 181st St.	0838	64th Ave. & 184th St.	0840
79	64th Ave. & 184th St.	0848	182nd & 69th Ave.	0850
72	182nd & 69th Ave.	0858	69th Ave. & 181st St.	0859
68	69th Ave. & 181st St.	0905	69th Ave. & 181st St.	0906
65	69th Ave. & 181st St.	0912	69th Ave. & 180th St.	0914
59	69th Ave. & 180th St.	0920	182nd St. & 73rd Ave.	0923
56	182nd St. & 73rd Ave.	0929	186th St. & 75th Ave.	0931
50	186th St. & 75th Ave.	0937	193rd St. & 75th Ave.	0941
47	193rd St. & 75th Ave.	0947	196th St. & 75th Ave.	0949
42	196th St. & 75th Ave.	0950	Union TPK & 184th St.	1000
39	Union TPK & 184th St.	1005	181st St. & Union TPK	1007

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 50 - DAY 1 (Cont.)			
36	181st & Union TPKE	1013	179th & Union TPKE	1016
31	179th & Union TPKE	1022	179th & 75th Ave.	1024
29	179th & 75th Ave.	1031	174th St. & 76th Ave.	1036
19	174th St. & 76th Ave.	1052	Birch St. & Willow	1152
2	Birch St. & Willow	1208	Hoffman Rd. & Plaza Ave.	1219
25	Hoffman Rd. & Plaza Ave.	1224	171st & 71st Ave.	1257
20	171st & 71st Ave.	1303	77th Ave.	1314
16	77th Ave.	1322	141st St. & 71st Rd.	1326
13	141st St. & 71st Rd.	1333	142nd St. & 71st Rd.	1335
9	142nd St. & 71st Rd.	1342	70th Rd. & Main St.	1348
4	70th Rd. & Main St.	1357	N. Henry St.	1426
	TRUCK 50 - DAY 2			
0	North Henry St.	0700	Vernon & 43rd St.	0714
75	Vernon & 43rd St.	0724	83rd & 34th St.	0747
69	83rd & 34th St.	0753	79th St. & 32nd Ave.	0758
64	79th St. & 32nd Ave.	0803	78th St. & 32nd Ave.	0818
58	78th St, & 32nd Ave.	0827	82nd St. & 30th Ave.	0832
51	82nd St. & 30th Ave.	0840	32nd Ave. & 84 St.	0843
45	32nd Ave. & 84th St.	0850	86th St. & 32nd Ave.	0851
39	86th St. & 32nd Ave.	0912	88th St. & 30th Ave.	0921
32	88th St. & 30th Ave.	0927	89th St. & 30th Ave.	0929
23	89th St. & 30th Ave.	0937	92nd St. & 31st Ave.	0941
18	92nd St. & 31st Ave.	0949	96th St. & 34th Ave.	0952
5	96th St. & 34th Ave.	0958	College Point Crossway	1008
	College Point Crossway	1015		
	TRUCK 50 - Day 3			
0	N. Henry St.	0700	128 & College Point Crossway	0732
100	College Point Crossway	0741	65th Ave. & 157th St.	0806
95	65th Ave. & 157th St.	0813	78th Rd & 160th St.	0820
91	78th Rd. & 160th St.	0828	165th St. & Goethals Ave.	0833
84	165th St. & Goethals Ave.	0847	85th Ave. & 165th St.	0851
80	85th Ave. & 165th St.	0900	161st & Hillside Ave.	0909
76	161st & Hillside Ave.	0916	89th & 184th St.	0924
72	89th & 184th St.	0930	186th St. & Jamaica	0932

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 50 - DAY 3			
68	186th St, & Jamaica Ave.	0938	91st Ave. & 189th St.	0941
61	91st Ave. & 189th St.	0951	198th St. & 120th Ave.	1003
57	198th St. & 120th Ave.	1010	223rd St. & 118th Ave.	1016
50	223rd St. & 118th Ave.	1022	233rd St. & 120th Ave.	1025
47	233rd St. & 120th Ave.	1030	232nd St. & 120th Ave.	1032
42	232nd St. & 120th Ave.	1038	137th Ave. & 256th St.	1044
37	137th Ave. & 256th St.	1051	Newhall Ave. & 241st St.	1057
31	Newhall Ave. & 241st St.	1114	145th Ave. & Francis Blvd.	1118
28	145th Ave. & Francis Blvd.	1124	134th Ave. & 244th St.	1130
25	134th Ave. & 244th St.	1145	Hillside Ave., Springfield	1206
19	Hillside Ave., Springfield	1245	218 PL & 90th Ave.	1248
12	218 Pl. & 90th Ave.	1258	90th Ave. & 222	1301
9	90th Ave. & 222	1308	25th Ave. & 169th Ave.	1320
5	25th Ave. & 169th Ave.	1330	25 Drive & 157th St.	1335
0	25 Drive & 157th St.	1345	Norman & Newel	1411
	TRUCK 50 - DAY 4			
50	N. Henry St.	0714	58th St. & 148th St.	0733
47	58th St. & 148th St.	0740	61st St. & 148th Pl.	0745
41	61st St. & 148th Pl.	0758	Fairchild Ave. & Fresh Meadow Lane	0809
36	Fairchild Ave. & Fresh Meadow	0819	201st St. & 58th Ave.	0827
29	201st St. & 58th Ave.	0835	198th St. & 58th Ave.	0838
25	198th St. & 58th Ave.	0853	58 Ave. & 201st St.	0858
21	58th Ave. & 201st St.	0904	213 St. & 56th Ave.	0906
14	213th St. & 56th Ave.	0911	211th St. & 53rd Ave.	0913
10	211th St. & 53rd Ave.	0920	201st St. & 35th Ave.	0927
10	201st St. & 35th Ave.	0937	College Point Blvd.	0949
100	College Point Blvd.	1000	33rd Ave. & 150th Pl.	1019
96	33rd Ave. & 150th Pl.	1024	146th St. & 17 Ave.	1030
91	146th St. & 17th Ave.	1036	148th St. & 12th Ave.	1038
81	148th St. & 12th Ave.	1043	10th Ave. & 147th St.	1045
83	10th Ave. & 147th St.	1051	7th Ave. & 147th St.	1052
79	7th Ave. & 147th St.	1102	9th Ave. Leggett Pl.	1106
74	9th Ave. & Leggett Pl.	1113	14th Ave. & 166th St.	1118
74	14th Ave. & 166th St.	1124	16th Ave. & 163rd St.	1128
71	16th Ave. & 163rd St.	1135	166th St. & 23rd Ave.	1138
69	166th St. & 23rd Ave.	1144	154th St. & 20th Rd.	1200
69	154th St. & 20th Rd.	1237	193rd St. & 37th Ave.	1245

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 50 - DAY 4 (Cont.)			
68	193rd St. & 37th Ave.	1252	162nd St. & 43rd Ave.	1257
68	162nd St. & 43rd Ave.	1307	157th St. & Laburnum Ave.	1320
67	157th St. & Laburnum Ave.	1326	Kalmia Ave. & Parsons	1328
66	Kalmia Ave. & Parsons	1335	N. Henry St.	1411
	TRUCK 50 - DAY 5			
32	N. Henry St.	0715	124th St. & 23rd Ave.	0738
29	124th St. & 23rd Ave.	0744	123rd St. & 21st Ave.	0746
25	123rd St. & 21st Ave.	0755	121st St. & 9th Rd.	0800
21	121st St. & 9th Rd.	0807	115th St. & 14th Rd.	0811
18	115th St. & 14th Rd.	0829	115th St. & 17th Rd.	0831
14	115th St. & 17th Rd.	0837	149th & 9th Ave.	0840
11	149th & 9th Ave.	0845	147th St. & 10th	0846
8	147th St. & 10th	0854	Whitestone Expressway & 7th Ave.	0855
5	Whitestone Expressway & 7th	0901	150th St. & 14th Ave.	0904
0	150th St. & 14th Ave.	0914	178th St. & College Point Crossway	0922
100	178th & College Point Crossway	0950	149th St. & 17th Rd.	0959
97	149th St. & 17th Rd.	1005	159th St. & Cross Island Pkwy	1011
92	159th & Cross Island Pkwy	1020	13th Ave. & 160th St.	1022
89	13th Ave. & 160th St.	1027	175th St. & 73rd Ave.	1047
85	175th St. & 73rd Ave.	1052	172nd St. & 69th Ave.	1054
81	172nd St & 69th Ave.	1101	76th Ave. & 175th St.	1105
78	76th Ave. & 175th St.	1118	75th Ave. & Utopia Pkwy	1120
60	75th Ave & Utopia Pkwy	1140	75th Ave. & Utopia Pkwy	1141
52	75th Ave. & Utopia Pkwy	1151	76th Ave. & Utopia	1153
45	76th Ave. & Utopia	1208	Utopia & Union Tpke	1209
37	Utopia & Union Tpke	1215	177th St. & Union Tpke	1217
25	177th St. & Union Tpke	1225	193rd St. & Union Tpke	1228
25	193rd St. & Union Tpke	1331	75th Ave. & 196th St.	1333
18	75th Ave. & 196th St.	1348	39th Ave. & 55th St.	1412
15	39th Ave. & 55th St.	1420	50th Ave. & 48th St.	1427
15	50th Ave. & 48th St.	1448	N. Henry St.	1456
	TRUCK 50 - DAY 6			
20	N. Henry St.	0709	Nassau Ave. & Hausman Ave.	0712
16	Nassau Ave. & Hausman St.	0721	N. Henry St. & Norman	0725
16	N. Henry St. & Norman	0731	Engert Ave. & Eckford St.	0739

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 50 - DAY 6			
10	Engert & Eckerd St.	0745	Norman & Hausman St.	0749
100	Norman & Hausman St.	0806	Flushing Ave. & Woodward	0816
92	Flushing Ave. & Woodward	0829	Tonsor Ave. & Himrod St.	0834
87	Tonsor Ave. & Himrod St.	0839	Bleeker St. & Butler Ave.	0841
82	Bleeker St. & Butler Ave.	0849	Catalpa & 64th St.	0857
79	Catalpa & 64th St.	0909	Central Ave. & 67th Pl.	0912
75	Central Ave. & 67th Pl.	0917	88th Ave. & 77th St.	0931
71	88th Ave. & 77th St.	0938	76th St. & Park Lane	0945
68	76th St. & Park Lane	0948	85th St. & 85th Rd.	0950
64	85th St. & 85th Rd.	0956	94th St. & 85th Rd.	0959
60	94th St. & 85th Rd.	1009	98th St. & Park Lane S.	1028
57	98th St. & Park Lane S.	1033	86th Rd. & 102nd St.	1057
54	86th Rd. & 102nd St.	1104	88th Ave. & 104th St.	1107
50	88th Ave. & 104th St.	1115	95th Ave. & 115th St.	1120
44	95th Ave. & 115th St.	1126	116th St. & Liberty Ave.	1129
40	116th St. & Liberty Ave.	1137	107th & Lefferts Blvd.	1139
37	107th & Lefferts Blvd.	1144	103 Ave. & 104th Ave.	1150
37	103rd Ave. & 104th St.	1155	94th St. & Liberty Ave.	1200
37	94th St. & Liberty Ave.	1221	93th St. & Sutter Ave.	1223
32	93rd St. & Sutter Ave.	1229	86th St. & 106th Ave.	1236
29	86th St. & 106th Ave.	1239	133rd Ave. & 82nd St.	1243
27	133rd Ave. & 82nd St.	1250	91st & 103rd Ave.	1254
23	91st & 103rd Ave.	1258	81st St. & Liberty Ave.	1301
20	81st St. & Liberty Ave.	1308	Myrtle Ave. & 78th St.	1322
16	Myrtle Ave. & 78th St.	1328	Woodhaven Blvd. & Cooper Ave.	1331
16	Woodhaven & Cooper Ave.	1338	N. Henry St.	1356
	TRUCK 51 - DAY 1			
	132nd & Broadway St.	0825	Blake Ave. & Stone Ave.	0947
	Blake Ave. & Stone Ave.	1445	132nd & Broadway	1540
	TRUCK 51 - DAY 2			
100	130th St. & Broadway	0816	129th & Amsterdam	0820
100	129th & Amsterdam	1024	116th & pleasant Ave.	1043
100	116th & Pleasant Ave.	1112	130th St. & Broadway	1132
100	130th St. & Broadway	1306	129th & Amsterdam	1310
100	129th & Amsterdam	1506	130th St. & Broadway	1512

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 51 - DAY 3			
100	130th St. & Broadway	0835	124th St. & Park St.	0843
100	124th St. & Park Ave.	0910	East Gunhill Rd. & Barnes	0932
100	East Gunhill Rd. & Barnes	1410	130th St. & Broadway	1446
	TRUCK 51 - DAY 4			
100	130th & Broadway	0825	Pelham Pkwy & Lurting	0853
100	Pelham Pkwy & Lurting	1311	129th & Amsterdam	1341
100	129th & Amsterdam	1510	130th & Broadway	1515
	TRUCK 52 - DAY 1			
100	Canal & Hudson	0917	NJ & Newark	0932
75	Newark NJ	0934	Lodi NJ	1017
50	Lodi NJ	1100	NJ	1143
100	NJ	1208	Lodi NJ	1308
0	Lodi NJ	1337	Canal & Hudson	1450
100	Canal & Hudson	1505	W. 35th & 8th Ave.	1525
0	W. 35th & 8th Ave.	1644	Canal & Hudson	1700
	TRUCK 52 - DAY 2			
25	Canal & Hudson	0800	Varick, 7th Ave.	0807
0	Varick, 7th Ave.	0851	Canal & Hudson	0901
100	Canal & Hudson	0952	Archer Ave. , 144th Place	1103
75	Archer Ave., 144th Place	1131	Far Rockaway	1219
0	Far Rockaway	1309	Canal & Hudson	1430
50	Canal & Hudson	1453	Hackensack	1612
0	Hackensack	1629	Canal & Hudson	1720
	TRUCK 52 - DAY 3			
0	6th Ave. Spring	0830	Howard	0835
	Howard	0900	Canal & Hudson	0933
50	Canal & Hudson	0956	6th Ave. & 19th St.	1015
30	6th Ave. & 19th St.	1040	25th St. & 7th Ave.	1050
30	25th St. & 7th Ave.	1059	24th St. & 5th Ave.	1107
75	24th St. & 5th Ave.	1118	18th St. & Park	1123
20	18th St. & Park	1144	Lafayette & Bond	1156
0	Lafayette & Bond	1226	Varick & Hudson	1237

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 52 - DAY 3			
0	Varick & Hudson	1302	Canal & Hudson	1311
	TRUCK 52 - DAY 4			
100	Canal Hudson	0930	143rd St., Archer	1031
25	143rd St., Archer	1115	Sunrise Hwy. Ocean Ave.	1218
0	Sunrise Hwy, Ocean Ave.	1230	Hudson Canal	1437
	TRUCK 53 - DAY 1			
0	75 Forest, Meeker	1046	Richmound Terrace, Nicholas	1142
50	Richmound Terrace, Nicholas	1248	Bay One, NJ	1312
	Bay One, NJ	1405	Richmound Terrace, Nicholas	1436
	TRUCK 53 - DAY 3			
0	Richmound Terrace	0930	Bay One, NJ	1016
100	Bay One, NJ	1121	Richmound Terrace	1152
0	Richmound Terrace	1301	Bay One, NJ	1349
100	Bay One, NJ	1432	Richmound Terrace	1513
	TRUCK 53 - DAY 4			
25	Richmound Terrace, Nicholas	1130	Bay One, NJ	1223
100	Bay One, NJ	1325	Richmound Terrace, Nicholas	1400
	TRUCK 53 - DAY 5			
0	Richmound Terrace, Nicholas	0800	Bay One, NJ	0818
100	Bay One, NJ	0924	Richmound Terrace, Nicholas	0957
	TRUCK 54 - DAY 2			
100	37th St. & 11th Ave.	0525	Secaucus, NJ	0555
0	Secaucus, NJ	0631	37th & 11th St.	0700
100	37th & 11th St.	0722	Creary, NJ	0747
0	Creary, NJ	0806	49th St. & Madison Ave.	0840
0	49th St. & Madison Ave.	0911	45th St. & U.N. Plaza	0925
100	45th St. & U.N. Plaza	0950	Secaucus, NJ	1032

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 54 - DAY 2 (Cont.)			
0	Secaucus, NJ	1040	E. 45th St. & U.N. Plaza	1132
0	E. 45th St. & U.N. Plaza	1141	Duane St. & W. Broadway	1225
100	Duane St. & W. Broadway	1335	37th St. & 11th Ave.	1355
	TRUCK 54 - DAY 3			
100	37th St. & 11th Ave.	0658	Carney, NJ	0752
0	Carney, NJ	0800	37th St. & 11th Ave.	0832
100	37th St. & 11th Ave.	1014	Secaucus, NJ	1145
0	Secaucus, NJ	1155	72nd St. & 3rd Ave.	1244
0	72nd St. & 3rd Ave.	1258	37th St. & 11th Ave.	1320
	TRUCK 55 - DAY 2			
100	N.Y. City Terminal Market	0627	86th St. & 7th Ave.	0704
95	86th St. & 7th Ave.	0712	Shore Pkwy & Bay Pkwy	0723
90	Shore & Bay Pkwy	0735	Burgher Ave.	0754
86	Burgher Ave.	0800	Forest Ave.	0825
80	Forest Ave.	0830	Forest Ave.	0836
75	Forest Ave.	0842		0857
75		0902		0944
0	Rahway Ave. & Pearl St.	1012	N.Y. City Terminal Market	1422
	TRUCK 55 - DAY 3			
100	N.Y. City Terminal Market	0618	33rd St. & Astoria Blvd.	0712
90	33rd St. & Astoria Blvd.	0727	34th Ave. & 46th St.	0738
80	34th Ave. & 46th St.	0748	Queens Blvd. & 50th St.	0756
85	Queens Blvd. & 50th St.	0811	Queens Blvd. & Woodhaven Blvd.	0822
75	Queens Blvd. & Woodhaven Ave.	0830	Woodhaven Blvd. & 23rd St.	0842
70	Woodhaven Blvd. & 23rd St.	0852	Flushing Ave. & 61st St.	0904
60	Flushing Ave. & 61st St.	0914	Northern Blvd. & 146th St.	0932
54	Northern Blvd. & 146th St.	0944	Northern Blvd. & 195th St.	0952
50	Northern Blvd. & 195th St.	1002	Northern Blvd.	1016
40	Northern Blvd.	1025	Hillside Ave. & Hollis Ct.	1120
33	Hillside Ave. & Hollis Ct.	1129	Hillside Ave. & 144th St.	1144

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 55 - DAY 3 (Cont.)			
	Hillside Ave. & 144th St.	1210	Rockway Blvd. & 94th St.	1220
0	Rockway Blvd. & 94th St.	1235	N.Y. City Terminal Market	1322
	TRUCK 55 - DAY 4			
100	Hunts Point Market	0604	Coop City & Wetstone	0623
90	Coop City & Wetstone	0630	Queen Blvd & 50th St.	0701
80	Queen Blvd. & 50th St.	0711	Queens Blvd. & Metropolitan Ave.	0726
70	Queens Blvd. & Metropolitan	0740	Woodhaven & Rockway Blvd.	0800
65	Woodhaven & Rockway Blvd.	0809	No Cross Streets	0846
50	No Cross Streets	0908	Independence Ave.	1017
40	Independence Ave.	1032	No cross streets	1058
35	No cross streets	1139	No cross streets	1202
0	No cross streets	1223	NYC Terminal Market	1312
	TRUCK 56 - DAY 1			
0	Springfield Blvd. & Merick Rd.	0745	Price Pkwy	0902
75	Price Pkwy	1058	Grand Ave.	1120
50	Grand Ave.	1203	Oceanside Rd.	1233
3	Oceanside Rd.	1254	No cross streets	1421
10	No cross streets	1508	Springfield Blvd. & Merick Rd.	1550
	TRUCK 56 - DAY 6			
25	Springfield Rd. & Merick Rd.	0736	No cross street	0809
25	No cross street	0845	Route 110 & Prince Pkwy	0926
25	Route 110 & Prince Pkwy	1212	Marine St, & Baiting Rd.	1319
50	Marine St. & Baiting Place Rd.	1338	Grand Ave. & McConnell Ct.	1405
50	Grand Ave. & McConnell Ct.	1521	Oak St. & Brook St.	1547
50	Oak & Brook St.	1617	Hargale Rd. & Mott St.	1659
5	Hargale Rd. & Mott 3t.	1745	Springfield Blvd. & Merick Rd.	1834
	TRUCK 57 - DAY 1			
0	Maspeth	1335	Crescent & 39th Ave.	1150
0	Crescent & 39th Ave.	1607	Maiden Lane & William St.	1640

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 57 - DAY 1			
100	Maiden Lane & William St.	1709	FDR Drive & 36th St.	1728
0	FDR Drive & 36th St.	1729	Maiden Lane & William St.	1750
100	Maiden Lane & William St.	1804	FDR Drive & 36th St.	1823
0	FDR Drive & 36th St.	1824	Maiden Lane & William St.	1844
100	Maiden Lane & William St.	1901	FDR Drive & 36th St.	1920
0	FDR Drive & 36th St.	1922	Maiden Lane & William St.	1942
100	Maiden Lane & William St.	1906	FDR Drive & 36th St.	2016
0 FDR	FDR Drive & 36th St.	2018	Maiden Lane & William St.	2036
100	Maiden Lane & William St.	2050	FDR Drive & 36th St.	2111
0	FDR Drive & 36th St.	2114	Maiden Lane & William St.	2128
100	Maiden Lane & William St.	2146	FDR Drive & 36th St.	2101
0	FDR Drive & 36th St.	2103	Maiden Lane & William St.	2117
100	Maiden Lane & William St.	2229	FDR Drive & 36th St.	2243
0	FDR Drive & 36th St.	2246	Maiden Lane & William St.	2301
100	Maiden Lane & William St.	2311	FDR Drive & 36th St.	2331
0	FDR Drive & 36th St.	2332	Crescent & 39th St.	2344
	TRUCK 57 - DAY 2			
0	Crescent & 39th St.	0731	2nd Ave. & 116th St.	0828
100	2nd Ave. & 116th St.	0907	West Side Highway & Cedar St.	0948
0	West Side Highway & Cedar St.	0950	2nd Ave. & 116th St.	1101
100	2nd Ave. & 116th St.	1107	West Side Highway & Cedar St.	1145
0	West Side Highway & Cedar St.	1152	2nd Ave. & 116th St.	1311
100	2nd Ave. & 116th St.	1327	West Highway & Cedar St.	1409
0	West Side Highway & Cedar St.	1412	2nd Ave. & 116th St.	1449
100	2nd Ave. & 116th St.	1505	Hunts Point Avenue	1524
0	Hunts Point Ave.	1529	2nd Ave. & 116th St.	1550
100	2nd Ave. & 116th St.	1603	Hunts Point Ave.	1622
0	Hunts Point Ave.	1626	Crescent & 39th Ave.	1650
0	Crescent & 39th Ave.	1653	Maiden Lane & William St.	1721
100	Maiden Lane & William St.	1734	FDR Drive & 36th Ave.	1751
0	DSR Drive & 36th Ave.	1755	Maiden Lane & William St.	1813
100	Maiden Lane & William St.	1824	FDR Drive & 36th St.	1845
0	FDR Drive & 36th St.	1850	Maiden Lane & William St.	1906
100	Maiden Lane & William St.	1918	South St. & Market	1924
0	South St. & Market	1925	Maiden Lane & William St.	1927

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 57 - DAY 2 (Cont.)			
100	Maiden Lane & William St.	1940	South St. & Market	1944
0	South St. & Market	1945	Maiden Lane & William St.	1948
100	Maiden Lane & William St.	2010	South St. & Market	2014
0	South St. & Market	2015	Maiden Lane & William St.	2018
100	Maiden Lane & William St.	2032	South St. & Market	2036
0	South St. & Market	2037	Maiden Lane & William St.	2040
100	Maiden Lane & William St.	2055	South St. & Market	2101
0	South St. & Market	2102	Maiden Lane & William	2105
100	Maiden Lane & William St.	2117	South St. & Market	2123
0	South St. & Market Lane	2124	Crescent & 39th St.	2140
	TRUCK 58 - DAY 2			
0	34th St. & 12th Ave.	0615	Erie & Lack. Terminal	0632
100	Erie & Lack. Terminal	0645	Saw Mill Rd. & Lake	0805
0	Saw Mill Rd. & Lake	1540	Erie & Lack. Terminal	1729
0	Erie & Lack. Terminal	1735	34th St. & 12th Ave.	1755
	TRUCK 58 - DAY 4			
0	34th & 12th St.	0610	Erie & Lack. Terminal	0625
100	Erie & Lack. Terminal	0635	Lane & Saw Mill Rd.	0746
0	Lane & Saw Mill Rd.	1405	Erie & Lack. Terminal	1500
0	Erie & Lack. Terminal	1510	34th & 12th St.	1545
	TRUCK 58 - DAY 5			
0	34th & 12th Ave.	0612	Erie & Lack. Terminal	0625
100	Erie & Lack. Terminal	0641	Saw Mill Rd. & Lake Ave.	0732
0	Saw Mill Rd. & Lake Ave.	1350	Erie & Lack. Terminal	1438
0	Erie & Lack. Terminal	1449	34th & 12th Ave.	1610
	TRUCK 58 - DAY 6			
0	34th & 12th Ave.	0605	Erie Lack. Terminal	0617
100	Erie & Lack. Terminal	0633	Saw Mill Rd. & Lake Ave.	0715
0	Saw Mill Rd. & Lake Ave.	1356	Erie & Lack. Terminal	1450

% VISIBLE LOAD	ORIGIN	TIME LEFTQ ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 58 - DAY 6 (Cont.)			
0	Erie & Lack. Terminal	1505	34th & 12th St.	1552
	TRUCK 59 - DAY 1			
100	58th & Maspeth	0440	Westchester & Sand	0508
90	Westchester & Sand	0533	Baychester & Pitman	0546
80	Baychester & Pitman St.	0603	White Plains & 232nd St.	0608
70	White Plains & 232nd St.	0641	Pelham Pkwy & Lurting	0641
60	Pelham Pkwy & Lurting	0658	Williambridge & Morris	0704
50	Williamsbridge & Morris	0709	Tremont & Randall St.	0722
40	Tremont & Randall St.	0749	GunHill Rd. & Bronywood	0801
30	Gun Hill Rd. Bronywood	0814	Gun Hill Rd. & DeKalb	0825
20	Gun Hill Rd. & DeKalb	0829	Grant Concourse & 204th St.	0835
10	Grand Concourse 7 204th St.	0853	Park View & 196th St.	0858
0	Park View & 196th St.	0924	58th & Maspeth St.	1008
	TRUCK 59 - DAY 2			
100	58th & Maspeth St.	0455	Westchester & St. Theresa St.	0523
90	Westchester & St. Theresa St.	0549	Williamsbridge & Rhind Ave.	0558
80	Williamsbridge & Rhind Ave.	0612	Tremont & Roosevelt Rd.	0638
70	Tremont & Roosevelt	0711	Baychester & Fremont	0728
60	Baychester & Fremont	0750	White Plains Rd. & 232nd St.	0758
50	White Plains Rd. & 232nd St.	0855	Gun Hill Rd. & Bronywood	0902
40	Gun Hill Rd. & Bronywood	0920	Grand Concourse & 204th St.	0933
30	Grand Concourse & 204th St.	0945	Creston & 198th St.	0948
15	Creston & 198th St,	0955	Park View & 196th St.	0958
0	Park View & 196th St. v	1000	58th & Maspeth St.	1116
	TRUCK 60 - DAY 1			
0	4th Ave. & 21st St.	0656	Kane St. & Sedwich St.	0718
0	Kane St. & Sedwich St.	0826	Secaucus St.	0927
0	Secaucus St.	1006	Senaca Ave. & Flushing Ave.	1117
100	Senaca Ave. & Flushing Ave.	1456	4th Ave. & 21st St.	1605

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 60 - DAY 2			
0	Pier 9B	0945	Secaucus St.	1030
0	Secaucus, NJ	1046	Seneca Ave. & Flushing	1212
100	Seneca Ave. & Flushing	1646	21st & 4th Ave.	1755
	TRUCK 60 - DAY 3			
100	21st & 4th Ave.	0801	Pier 9A	0814
0	Pier 9A	0928	21st & 4th Ave.	0938
100	21st & 4th Ave.	0947	Bayonne	1023
0	Bayonne, NJ	1050	Maher Terminal	1115
0	Maher Terminal	1606	21st St. & 4th Ave.	1714
	TRUCK 61 - DAY 1			
0	Seabring & Van Brunt	2005	Ferris & Walcott	2011
100	Ferris & Walcott	2050	40th & 2nd	2153
0	40th & 2nd St.	2219	Ferris & Walcott	2332
100	Ferris & Walcott	2344	40th & 2nd	0217
0	40th & 2nd	0240	Ferris & Walcott	0340
100	Ferris & Walcott	0355	40th & 2nd	0440
0	40th & 2nd	0523	Seabring & Van Brunt	0617
	TRUCK 61 - DAY 3			
100	Seabring & Van Brunt	2025	40th & 2nd	2217
0	40th & 2nd	2247	Walcott & Ferris	0111
100	Walcott & Ferris	0146	40th & 2nd	0320
0	40th & 2nd	0350	Walcott & Ferris	0501
100	Walcott & Ferris	0512	Seabring & Van Brunt	0519
	TRUCK 62 - DAY 1			
0	75th Frost St.	0831	W. Henry St.	0843
100	W. Henry St.	0854	Harison St.	0931
98	Harison Ave.	0949	St. Johns & Troy Ave.	0958
90	St. Johns & Troy Ave.	1007	Lincoln Pl.	1012
5	Lincoln Pl.	1010	634th Union St.	1045

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 62 - DAY 1 (Cont.)			
80	634th Union St.	1108	President St. & Utica Ave.	1120
70	President St. & Utica Ave.	1144	1427 Pitkin Ave.	1151
60	1427 Pitkin Ave.	1216	Pennsylvania Ave. & Pitkin Ave.	1227
50	Pennsylvania Ave. & Pitkin	1236	Malta St.	1249
30	Malta St.	1256	Euclick & Blake Ave.	1305
0	Euclick & Blake Ave.	1319	98th St.	1401
70	98th St.	1437	265th Pennsylvania Ave.	1441
	TRUCK 62 - DAY 2			
100	265th Pennsylvania Ave.	0746	E. 49th St.	0808
95	E. 49th St.	0813	Ryder St. 1639	0828
90	Ryder St. 1639	0835	Quentin Rd. & 32nd St.	0839
85	Quentin Rd. & 32nd St.	0845	E. 3rd St. 2297	0900
80	E. 3rd. St. 2297	0904	Dale & Quentin Rd.	0919
70	Dale & Quentin Rd.	0931	21st Ave. & 59th St.	0944
55	21st Ave. & 59th St.	0949	2178 & 69th St.	1000
40	2178 & 69th St.	1212	70th St. & 16th Ave.	1019
30	70th St. & 16th Ave.	1029	72nd St. & 21st Ave.	1035
25	72nd St. & 21st Ave.	1047	1st Gave	1107
15	1st Gave	1124	Court St. & Bryant St.	1134
100	Court St. & Bryant St.	1156	Brant & Smith St.	1218
90	Brant & Smith St.	1229	E. 2nd St. & Caton Ave.	1256
85	E. 2nd St. & Caton Ave.	1308	E. 3rd St. Ave. C	1313
70	E. 3rd St. Ave. C	1370	Rogers & 693rd St.	1241
	Rogers & 693rd Ave.	1348	125th E. 31st St.	1401
65	125th E. 31st St.	1413	265th Pennsylvania Ave.	1432
	TRUCK 62 - DAY 3			
60	265th Pennsylvania Ave.	0750	354th Pennsylvania Ave.	0751
50	354th Pennsylvania Ave.	0804	407th Jerome St.	0814
40	407th Jerome St.	0822	698th Shweck St.	0830
30	698th Shweck St.	0840	Jamaica Bay Oil Corp., 140	0852
100	Jamaica Bay Oil Corp., 140	0930	E. 36th St. & 1573	0949

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 62 - DAY 3 (Cont.)			
90	E. 36th St. & 1573	0957	1016 Ave.	1010
80	1016th Ave.	1024	Ocean Pkwy	1035
75	Ocean Pkwy	1040	63rd St. & Bay Pkwy	1051
70	63rd St. & Bay Pkwy	1057	84th St. 2131	1108
65	84th St. & 2131	1122	57th St. & 21st Ave.	1129
60	57th St. & 21st Ave.	1143	5th Ave. 40th St.	1200
50	5th Ave. & 40th St.	1213	E. 3rd St. & 534	1249
45	E. 3rd St. & 534	1258	1140th Rogers Ave.	1312
40	1140th Rogers Ave.	1322	Classon & Rogers Ave.	1327
20	Classon & Rogers Ave.	1416	Cleveland St., 675	1443
10	Cleveland St., 675	1456	Jamaica Bay Oil Corp.	1506
100	Jamaica Bay Oil Corp.	1519	265th Pennsylvania Ave.	1535
	TRUCK 62 - DAY 4			
70	265th Pennsylvania Ave.	0816	Alabama Ave. & Linden Blvd.	0827
65	Alabama Ave. & Linden Blvd.	0839	Bradford St. & Pitkin Ave.	0844
60	Bradford St. & Pitkin Ave.	0849	Dumant Ave.	0858
55	Dumant Ave.	0907	Baffalo Ave & Prospect Place	0929
45	Baffalo Ave. & Prospect Pl.	0935	Brooklyn Ave. & President St.	0953
40	Brooklyn Ave. & President St.	0955	35th Schrmerhorst	1028
30	35th Schrmerhorst	1034	Waren St. & Columbia St.	1043
25	Waren St. & Columbia St.	1051	Court St.	1100
100	Court St.	1110	N. 1st St.	1136
90	N. 1st St.	1200	Harrison Ave. & Hewes St.	1210
80	Harrison Ave. & Hewes St.	1223	43rd St. & Church Ave.	1339
45	43rd St. & Church Ave.	1355	265th Pennsylvania Ave.	1415
	TRUCK 62 - DAY 5			
25	265 Metropolitan Ave.	0754	92nd St. & 101st Ave.	0818
20	92nd St. & 101st Ave.	0828	140 Jamaica Bay Oil Ave.	0846
70	140 Jamaica Bay Oil Corp.	0906	South Rd. & Suphin Ave.	0922
65	South Rd. & Suphin Ave.	0927	Liberty Ave. & 169th St.	0932
60	Liberty Ave. & 169th St.	0940	190th St. & 48th Ave.	1006

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 62 - DAY 5			
55	190th St. & 48th Ave.	1015	Lamunt Ave. & Glean St.	1042
50	Lamunt Ave. & Glean St.	1050	43rd Ave. & 61st St.	1107
45	43rd Ave. & 61st St.	1124	6829, 76th St.	1148
40	6829, 76th St.	1157	No cross St.	1230
100	No cross st.	1240	Greene Ave. & Stuyvan Ave.	1310
95	Greene Ave. & Stuyvan Sant Ave.	1317	Rochester Ave.	1332
85	Rochester Ave.	1352	258th Albany Ave.	1359
80	258th Albany Ave.	1406	No cross st.	1408
75	No cross street	1424	265th Pennsylvania Ave.	1436
	TRUCK 64 - DAY 1			
100	21st & 4th Ave.	0711	Van Brunt & Irving	0737
0	Van Brunt & Irving	1008	Seneca & Flushing	1110
100	Seneca & Flushing	1157	Van Brunt & Irving	1323
0	Van Brunt & Irving	1602	21st & 4th Ave.	1623
	TRUCK 64 - DAY 2			
0	21st St. & 4th Ave.	0626	Meserole & Banker	0730
100	Meserole & Banker	0735	Port Newark	1106
100	Port Newark	1711	176th & Webster	2021
0	176th & Webster		21st & 4th Ave.	
	TRUCK 64 - DAY 3			
50	21st St. & 4th Ave.	0725	Cooper St. & 78th St.	0834
25	Cooper St. & 78th St.	0933	Willams Ave. & Dewet	1016
0	Willams Ave. & Dewet	1148	Atlantic Ave. & 133rd St.	1214
50	Atlantic Ave. & 133rd Ave.	1339	21st St. & 4th Ave.	1428
50	21st St. & 4th Ave.	1432	1st Ave. & 58th St.	1446
0	1st Ave. & 58th St.	1551	21st & 4th Ave.	1605
	TRUCK 65 - DAY 1			
0	Frost & Meeker	0805	Richmound Terrace & Nicholas	0844

% VISIBLE LOAD	ORIGIN	TIME LEFT ORIGIN	DESTINATION	ARRIVAL TIME
	TRUCK 65 - DAY 1 (Cont.)			
0	Richmound Terrace & Nicholas	0905	Pennsylvania	1142
100	Pennsylvania	1333	Richmound & Nicholas	1608
	TRUCK 65 - DAY 2			
100	Baltimore	1400	Richmound	1733

Appendix I

PROGRAM LISTINGS

The programs developed for the EPA truck study are written in COBOL, Assembly, and FORTRAN languages. The FORTRAN and most of the COBOL programs use Assembly language subroutines. The Assembly language programs use MACROS (mainly for input/output) which are unique to DOS and are not included in the listings. All of the programs in the system will run in a 56K DOS partition.

1. Separate raw data files (7 track)
2. Format M4 cards for calibration data
3. List number scans in each time slot (HHMM)
4. Utility dump program (lists raw & calibrated tapes)
5. Average zero scans
6. Print zero distribution summary - Punch ES card for calibration
7. Load calibration data
8. Translation and edit program
9. Mode - Profile
10. Mode - Print summary tables
11. Mode - Condense summary records produced in Profile.
12. Mode combine truck days
13. List first 80 characters of each file (Debug aid)
14. Calibrated and raw listing program
15. Mode - Print spooled output (created in profile)
16. Apply initial edit - Load open and closed valve closure readings
17. Convert raw data to floating point
18. Horsepower model development

1 - SEPARATE RAW DATA FILES PROGRAM LISTING

```
// EXEC FFORTRAN
      COMMON X(1800)
      WRITE (3,82)
      KCN = 0
      ICN = 0
      ICM = 0
 1    CALL IC(1,4,1,X(1),1800)
      CALL IC(3,4,INC,LEN)
      IF (INC .NE. 0) GO TO 1
      IF (LEN .EQ. 80) GO TO 100
      CALL IC(2,5,X,1800)
      CALL IC(3,5,INDX)
 2    ICN = ICN + 1
      ICM = ICM + 1
      GO TO 1
 100  CONTINUE
      KCN = KCN + 1
      IF (KCN .EQ. 1) GO TO 105
      CALL IC(4,5)
 105  CALL IC(2,5,X,80)
      CALL IC(3,5,INDX)
      WRITE (3,80) ICN, ICM
      WRITE (3,81) (X(I),I=1,20)
      ICN = 0
      GO TO 1
 999  CONTINUE
C     CALL IC(4,5)
C     CALL IC(4,5)
C     CALL IC(3,5,INDX)
      WRITE (3,80) ICN, ICM
      WRITE (3,82)
      STOP
 80   FORMAT ('0BLOCKS = ',I10,10X,'ACCUM = ',I10, 10X,'LEN =',I10)
 81   FORMAT (20A4)
 82   FORMAT ('1')
      END
```

2 - FORMAT M4 CARDS FOR CALIBRATION DATA

```
// EXEC ASSEMBLY
         TITLE 'EPA FORMAT 66 -SPECDLCT CTL CARDS  120210ABC'
         PRINT NOGEN
         ENTER R12
         USING TAB,R11
LOOP     BAL   RS,RSYSIPT
LOOPX    PACK  CVB,KD+1(1)
         CVB   R2,CVB
         PACK  CVB,KC+5(2)
         CVB   R1,CVB
         BCTR  R1,C
         LH    R3,SKD
         LA    R1,C(R1,R3)
         STH   R1,MVC+4
         LA    R3,240
         L     R11,=A(TAB)
LOOP1    BAL   RS,RSYSIPT
         CLI   KD,C'*'
         BE    PUNCH
MVC      MVC   KD+1(2),KD
         MVC   TAB,KD
         MVC   TAB+23(3),KD+26
         MVC   TAB+26(3),KD+32
         MVC   TAB+29(1),KD+29
         LA    R11,L'TAB(R11)
         B     LOOP1
PUNCH    LR    R10,R11
         L     R11,=A(TAB)
         LA    R3,1(R3)
PLOOP    MVC   CC,=8CC' '
         OC    TAB(29),=29C'0'       DO NOT KILL PCS 30
         MVC   CD(2),TAB+1
         STC   R3,CD+2
         MVC   CD+4(4),TAB+6
         MVC   CD+9(2),TAB+11
         MVI   CD+11,C'.'
         MVC   CD+12(3),TAB+13
         MVC   CD+16(4),TAB+19
         MVC   CD+21(3),TAB+23
         MVC   CD+24(1),TAB+29
         MVC   CD+25(3),TAB+26
         MVC   CD+78(2),=C'M4'
         BAL   R9,WPCH
         LA    R11,L'TAB(R11)
         CR    R10,R11
         BNE   PLOOP
         BCT   R2,PUNCH
         B     LOOPX
EOJ      EQU   *
         MVC   CD,=80C' '
         BAL   R9,WPCH
         MVI   CL,15
         BAL   RS,WPCH
         EOJ
SKD      DC    S(KD)
RSYSIPT  RC    RS,SYSIPT,KD,EOJ
```

```
WPCH     PC    RS,SYSPCH,SS,81,CL
SS       DC    X'C1'
CC       DS    CL8C
KC       CS    CL8C
CAY      CS    CL1
CVB      CS  C
         LTORG
TAB      CS    CL3C
         END
```

3 - LIST NUMBER OF SCANS IN EACH TIME SLOT (HHMM)

```
// EXEC ASSEMBLY
         TITLE 'FPA LIST TAPES  12C21C ABC'
         PRINT NOGEN
         ENTER R12
         USING T1,R11
         USING TAB,R10
         ZAP  CD(4),=P'C'
         BAL  R9,RSYSIPT
         PACK  CD(4),CD(4)
         COMRG
         TM   23(R1),X'80'
         BZ   RESET
         ZAP  PRT,=P'1001'
RESET    MVI  SW+1,240
         L    R1C,=A(TAB)
         LA   R3,1000
         MVC  TAB(9),=3PL3'0'
         LA   R1C,9(R10)
         BCT  R3,*-6-4
         MVI  EJSW+1,24C
         ZAP  CNT,=P'0'
         ZAP  ZCNT,=P'0'
         ZAP  ZCNT1,=P'C'
         ZAP  PRT,=P'0'
         EXCP RCCB
         WAIT RCCB
         TM   RCCB+4,1
         BO   EOJ
         BAL  R9,OVRFL
READ     BAL  R9,RSYSO11
         OC   T1(30),=30C'0'
         BAL  R9,hSYSLST1
         PACK CVB,T1+6(3)
         OI   CVB+7,15
         CVB  R10,CVB
         MH   R1C,=H'3'
         A    R1C,=A(TAB)
         AP   TAB(3),=P'1'
         PACK CVB,T1+9(3)
         OI   CVB+7,15
         CVB  R1C,CVB
         MH   R10,=H'3'
         A    R10,=A(TAB1)
         AP   TAB(3),=P'1'
         PACK CVB,T1+12(3)
         OI   CVB+7,15
         CVB  R1C,CVB
         MH   R1C,=H'3'
         A    R10,=A(TAB2)
         AP   TAB(3),=P'1'
         CLC  T1(3C),=3CC'C'
         BE   ZERO1
         CLC  T1(2),=C'CO'
         BE   ZERO
SW       B    FIRST
         CLC  HOLD,T1
```

```
         BNE  PRINT
ACC1     MVC  HOLD,T1
ACC      AP   CNT,=P'1'
         B    READ
ZERO     AP   ZCNT,=P'1'
         B    ADD
ZERO1    AP   ZCNT1,=P'1'
         B    ADD
FIRST    MVI  SW+1,C
         B    ADD1
PRINT    XC   PR,PR
         AP   PRT,=P'1'
         MVI  CC,9
         MVC  PR(2),HOLD
         MVC  PR+4(2),HOLD+2
         MVI  PR+6,C'.'
         MVC  PR+7(2),HOLD+4
         OI   CNT+4,15
         OI  ZCNT+4,15
         OI  ZCNT1+4,15
         UNPK PR+10(1C),CNT
         UNPK PR+25(1C),ZCNT
         UNPK PR+4C(1C),ZCNT1
         CP   PRT,=P'1000'
         BE  EC
         BH   *+8
         BAL  R9,hSYSLST
        TM   CV,15
         BZ   *+8
         BAL  R9,OVRFL
ZAP      MVC  HOLD,T1
EJSW     B    ADD
         SPACE 2
         MVI  CV,15
         ZAP CLM1,=P'0'
         ZAP CLM2,=P'0'
         ZAP CLM3,=P'C'
         ZAP  REF,=P'C'
         LA   R3,C
         LA   R2,10C0
CUMPACC  EQU  *
         TM   CV,15
         BZ   DUMPACC1
         BAL  R9,OVRFL
         MVI  CC,9
         MVC  PR(52),HD1
         BAL  R9,hSYSLST
         XC   PR,PR
         BAL  R9,hSYSLST
CUMPACC1 EQU  *
         MVI  CC,9
         XC   PR,PR
         OI   REF+2,15
         UNPK PR(3),REF
         AP   REF,=P'1'
         ZAP  CUM,=P'C'
```

3 - LIST NUMBER OF SCANS IN EACH TIME SLOT (HHMM) (CONT.)

```
         LR    F1C,R3
         A     P1C,=A(TAB)
         OI    TAB+2,15
         UNPK  FR+5(5),TAB
         AP    CUM1,TAB
         OI    CUM1+2,15
         UNPK  PR+12(5),CUM1
         AP    CUM,TAB
         LR    F10,R3
         A     R10,=A(TAB1)
         OI    TAB+2,15
         UNPK  PR+22(5),TAB
         AP    CUM2,TAB
         OI    CUM2+2,15
         UNPK  PR+29(5),CUM2
         AP    CUM,TAB
         LR    R10,R3
         A     R10,=A(TAB2)
         CI    TAB+2,15
         UNPK  PR+39(5),TAB
         AP    CUM3,TAB
         OI    CUM3+2,15
         UNPK  PR+47(5),CUM3
         AP    CUM,TAB
         CP    CUM,=P'0'
         BE    *+4+4
         BAL   R9,hSYSLST
         LA    R3,3(R3)
         BCT   R2,DUMPACC
         SPACE 2
         AP    FILES,=P'1'
         CP    CD(4),FILES
         BE    EOJ
         B     RESET
EQ       XC    PR,PR
         MVI   CC,9
         BAL   R9,hSYSLST
         MVC   PR(20),=CL20'TRLNCATE'
         BAL   R9,hSYSLST
         XC    PR,PR
         B     ZAP
EOF      MVI   EJSb+1,0
         ZAP   PRT,=P'0'
         B     PRINT
OVRFL    LR    R0,R9
         MVI   CC,X'8B'
         BAL   R9,hSYSLST
         XC    PR,PR
         MVI   CC,17
         MVC   PR,HD
         BAL   R9,hSYSLST
         LR    R9,R0
         BR    R9
EOJ      MVI   CL,15
         BAL   R9,hSYSLST
         EOJ
```

```
         LTORG
FILES    DC    PL4'0'
CCb      CCb   2,HD,C,8C
RCCB     CCB   SYS011,CCb
CNT      DS    PL5
ZCNT     DS    PL5
ZCNT1    DS    PL5
PRT      DS    PL5
HD       DS    CL8C
CC       DS    CL1
PR       DS    CL80
CVB      DS    D
CUM      DC    PL3'0'
CUM1     DC    PL3'0'
CUM2     DC    PL3'0'
CUM3     DC    PL3'0'
REF      DC    PL3'0'
HC1      DC    CL5' '
         DC    C'—— RPM ——'
         DC    CL5' '
         DC    C'—— HP ——'
         DC    CL5' '
         DC    C'—— VS ———'
HOLD     DS    CL6
CD       DS    CL80
RSYS011  RT    R9,SYS011,T1,R11,30,1800,ECF,,,0,0
WSYSLST  PRTP  R9,SYSLST,CC,81,GV,CL,T1+360C,500,56
RSYSIPT  RC    R9,SYSIPT,CD,RESET
T1       DS    CL3C
         COM
TAB      DS    1000PL3
TAB1     DS    1000PL3
TAB2     DS    1000PL3
         END
```

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4 - UTILITY DUMP PROGRAM (LISTS RAW & CALIBRATED TAPES

```
// EXEC COBOL
01010  IDENTIFICATION DIVISION
01020  PROGRAM-ID.  'LIST1'.                                          C2802
01030  ENVIRONMENT DIVISION.                                          C2802
01040  INPUT-OUTPUT SECTION.                                          C2802
01050  FILE-CONTROL.                                                  C2802
01060      SELECT TAPIX ASSIGN 'SYS011' UTILITY 2400.                 C2802
01070      SELECT TAPIN ASSIGN 'SYS011' UTILITY 2400.                 C2802
01080      SELECT TAPOT ASSIGN 'SYS012' UTILITY 2400.                 C2802
01090      SELECT PRTF ASSIGN 'SYS009' UNIT-RECORD 1403.              C2802
       I-O-CONTROL.                                                   C2802
           SAME AREA FOR TAPIX, TAPOT.
01100  DATA DIVISION.
01110  FILE SECTION.                                                  C2802
01120  FD  TAPIX                                                      C2802
01130          RECORDING MODE F,                                      C2802
01140          LABEL RECORDS OMITTED,                                 C2802
01150          RECORD CONTAINS  40 CHARACTERS,                        C2802
01160          BLOCK CONTAINS 270 RECORDS,                            C2802
01170          DATA RECORD TAPIX-REC.
01180  01  TAPIX-REC.                                                 C2802
01190      07  TPX       PICTURE S99.                                 C2802
01200      07  TIMX      PICTURE S99V99.                              C2802
01210      07  VCX COMPUTATIONAL-1          OCCURS 5 TIMES.           C2802
           07  CHEF     COMPUTATIONAL-1.                              C2802
           07  CHEB  REDEFINES CHEF.
               14  CHE          PICTURE SV999.
               14  CHE1         PICTURE X.
01240      07  CHS      COMPUTATIONAL-1.
01250      07  CHA      COMPUTATIONAL-1.                              C2802
01260  FD  TAPIN                                                      C2802
01270          RECORDING MODE F,                                      C2802
01280          LABEL RECORDS OMITTED,                                 C2802
01290          RECORD CONTAINS  30 CHARACTERS,                        C2802
01300          BLOCK CONTAINS 120 RECORDS,                            C2802
01310          DATA RECORD TAPIN-REC.                                 C2802
01320  01  TAPIN-REC.                                                 C2802
01330      07  TRK       PICTURE S99.                                 C2802
01340      07  TIME      PICTURE S99V99.                              C2802
01350      07  VOL       PICTURE SV999   OCCURS 8 TIMES.              C2802
01360  FD  TAPOT                                                      C2802
01370          RECORDING MODE F,                                      C2802
01380          LABEL RECORDS OMITTED,                                 C2802
01390          RECORD CONTAINS  40 CHARACTERS,                        C2802
01400          BLOCK CONTAINS 90 RECORDS                              C2802
01410          DATA RECORD TAPOT-REC.
01420  01  TAPOT-REC.                                                 C2802
01430      07  TRK-O    PICTURE 99.                                   C2802
01440      07  TIME-O   PICTURE 99V99.                                C2802
01450      07  DAY-O     PICTURE XX.                                  C2802
01460      07  VOL-O   COMPUTATIONAL-1  OCCURS 8 TIMES.               C2802
01470  FD  PRTF                                                       C2802
01480          RECORDING MODE F, LABEL RECORDS OMITTED,               C2802
01490          DATA RECORD PRT.                                       C2802
01500  01  PRT.                                                       C2802
02010      07  FILLER   PICTURE X.                                    C2802
                                                                      C2802

02020      07  PRT1         PICTURE X(132).
02030      07  PRT2 REDEFINES PRT1.                                   C2802
02040          14  REC  PICTURE Z(7).                                 C2802
02050          14  FILLER PICTURE XXX.                                C2802
02060          14  P-TRK  PICTURE 99.                                 C2802
02070          14  FILLER  PICTURE XXX.                               C2802
02080          14  P-TIME  PICTURE 99.99.                             C2802
02090          14  P-VOL  PICTURE -----.999, OCCURS 6 TIMES.          C2802
02100          14  FILLER  PICTURE XXX.                               C2802
02110          14  R-V  PICTURE  -(7).9(3).                           C2802
02113          14  FILLER     PICTURE X(4).                           C2802
02115          14  P-ZERO     PICTURE X(4).                           C2802
02120      07  PRT3  REDEFINES  PRT1.
02130          14  PRT4   PICTURE X(40).                              C2802
02140          14  PRT5   PICTURE X(40).                              C2802
02150      07  PRT6  REDEFINES  PRT1.                                 C2802
02160          14  PRT7   PICTURE X(30).                              C2802
02170          14  PRT8   PICTURE X(30).                              C2802
02180          14  PRT9   PICTURE X(30).                              C2802
02190  WORKING-STORAGE SECTION.                                       C2802
02200  77  COMPW  COMPUTATIONAL-1.                                    C2802
02210  77  X1  PICTURE S999  COMPUTATIONAL.                           C2802
02220  77  CNT  PICTURE S9(7)  VALUE ZERO  COMPUTATIONAL-3.           C2802
02230  77  FLAG-INT      PICTURE X, VALUE SPACE.                      C2802
02235  77  ASTSW         PICTURE X, VALUE SPACE.                      C2802
       77  BSP  PICTURE S999 COMPUTATIONAL, VALUE 11.
02240  01  OPX.
02250      07  OPT         PICTURE X.                                 C2802
02260      07  CPFLAG      PICTURE X.                                 C2802
02270      07  CPCNT       PICTURE 9(7).
02280      07  FILLER      PICTURE X.                                 C2802
02290      07  OPBYF       PICTURE 9(7).                              C2802
02300  01  HEADINGS.                                                  C2802
02310      07  PRT3H.                                                 C2802
02320          14  FILLER      PICTURE X.                             C2802
02330          14  PRT3H1      PICTURE X(80).                         C2802
02340          14  FILLER      PICTURE X(11) VALUE ' CALIBRATED'.     C2802
02350      07  PRT6H.                                                 C2802
02360          14  FILLER      PICTURE X.                             C2802
02370          14  PRT6H1.                                            C2802
02380              20  PRT6HA      PICTURE X(30).                     C2802
02390              20  PRT6HB      PICTURE X(30).                     C2802
02400              20  PRT6HC      PICTURE X(30), VALUE SPACE.        C2802
02410          14  FILLER      PICTURE X(4) VALUE ' RAW'.             C2802
02420      07  PRTH.                                                  C2802
02430          14  FILLER      PICTURE X(17) VALUE '  RECORD  TRK    '.  C2802
02440          14  FILLER      PICTURE X(12) VALUE 'TIME        '.    C2802
02450          14  FILLER      PICTURE X(09) VALUE '3        '.       C2802
02460          14  FILLER      PICTURE X(09) VALUE '4        '.       C2802
02470          14  FILLER      PICTURE X(09) VALUE '5        '.       C2802
02480          14  FILLER      PICTURE X(09) VALUE '6        '.       C2802
02490          14  FILLER      PICTURE X(09) VALUE '7        '.       C2802
02500          14  FILLER      PICTURE X(09) VALUE '8        '.       C2802
03010          14  FILLER      PICTURE X(08) VALUE '9       '.        C2802
03020          14  FILLER      PICTURE X(16) VALUE '10           R/V'.  C2802
03030      07  LINCNT   PICTURE S9(3) VALUE ZERO  COMPUTATIONAL-3.    C2802
                                                                      C2802
```

4 - UTILITY DUMP PROGRAM (cont'd)

```
                                                          C2802
03040  PROCEDURE DIVISION.                                C2802
03050      ACCEPT OPX.                                    C2802
03060      IF OPBYP NOT NUMERIC                           C2802
03070          MOVE ZERO TO OPBYP.                        C2802
03080      ENTER LINKAGE.                                 C2802
03090          CALL 'INT' USING FLAG-INT.                 C2802
03100      ENTER COBOL.                                   C2802
03110      IF OPT = 8 OR     OPT = 9    OR                C2802
03120         OPT = 4 OPEN INPUT TAPIX WITH NO REWIND.    C2802
03130      IF OPT LESS THAN 4                             C2802
03140          OPEN INPUT TAPIN WITH NO REWIND.           C2802
03150      IF OPT = 2 OR OPT = 3 OPEN OUTPUT TAPOT.       C2802
03160               OPEN                                  C2802
03170          OUTPUT         PRTF.                       C2802
03180      IF OPT NOT = 2                                 C2802
03190      MOVE SPACE TO PRT,    WRITE PRT AFTER 0.       C2802
03200      IF OPT = 5 GO TO READ-RAW.                     C2802
03210      IF OPT = 6 GO TO READ-SEMI-RAW.                C2802
03220      IF OPT = 7 GO TO READ-SEMI-RAW.                C2802
03230      IF OPT LESS THAN 4 GO TO READ-LOOP-1.          C2802
03240      MOVE SPACE TO PRT.                             C2802
03250      READ TAPIX INTO PRT4 AT END STOP RUN.          C2802
03260      READ TAPIX INTO PRT5 AT END STOP RUN.          C2802
03270      MOVE PRT3 TO PRT3H1.                           C2802
03280  W-HD-1.                                            C2802
03290      WRITE PRT FROM PRT3H AFTER 0.                  C2802
03300      WRITE PRT FROM PRTH AFTER 2.                   C2802
03310      MOVE  2   TO LINCNT.                           C2802
03320      MOVE SPACE TO PRT.                             C2802
03330      WRITE PRT AFTER 1.                             C2802
03340      IF OPT = 4 OR CNT NOT = ZERO                   C2802
03350          GO TO READ-LOOX.                           C2802
03360  LIST-CAL.                                          C2802
03370      MOVE SPACE TO PRT.                             C2802
03380      READ TAPIX INTO PRT4 AT END STOP RUN.          C2802
03390      READ TAPIX INTO PRT5 AT END STOP RUN.
03395      IF PRT4 = '*' MOVE '*' TO ASTSW.               C2802
03400      WRITE PRT AFTER 1.                             C2802
03410      ADD 1 TO LINCNT.
03420      IF ASTSW = '*' GO TO LIST-CAL-1.               C2802
03430      IF LINCNT GREATER THAN 55 GO TO W-HD-1.        C2802
03440      GO TO LIST-CAL.                                C2802
03450  LIST-CAL-1.                                        C2802
03460      MOVE SPACE TO PRT.                             C2802
03470      WRITE PRT AFTER 1.                             C2802
03480      ADD 1 TO LINCNT.                               C2802
03490      IF LINCNT LESS THAN 45 GO TO READ-LOOX.        C2802
03500      WRITE PRT FROM PRT3H AFTER 0.                  C2802
04010      WRITE PRT FROM PRTH AFTER 2.                   C2802
04020      MOVE  2   TO LINCNT.                           C2802
04030      MOVE SPACE TO PRT.                             C2802
04040      WRITE PRT AFTER 1.                             C2802
04050  READ-LOOX.                                         C2802
04060      IF FLAG-INT = 1 GO TO END-FILE.                C2802
04070      READ TAPIX AT END GO TO END-FILE.              C2802
04080      MOVE SPACE TO PRT.
```

```
04090      ADD 1 TO CNT.  MOVE CNT TO REC.                              C2802
           IF OPT NOT = 9 GO TO SKIP-FIND-REC.
           IF VOX (3) GREATER THAN 0.9999
               COMPUTE OPCNT = CNT + 500,
               MOVE 8 TO OPT,
               GO TO SKIP-FIND-REC.
           GO TO READ-LOOX.
       SKIP-FIND-REC.
04100      IF CNT NOT GREATER THAN OPBYP                                C2802
04110          GO TO READ-LOOX.                                         C2802
04120      IF CNT GREATER THAN OPCNT GO TO END-FILE.                    C2802
04130      MOVE TRX TO P-TRK.                                           C2802
04140      MOVE TIMX TO P-TIME.                                         C2802
04150      IF TRX = 00 MOVE 'ZERO' TO P-ZERO.
04160      MOVE VOX (1) TO P-VOL (1).                                   C2802
04170      MOVE VOX (2) TO P-VOL (2).                                   C2802
04180      MOVE VOX (3) TO P-VOL (3).                                   C2802
04190      MOVE VOX (4) TO P-VOL (4).                                   C2802
04200      MOVE VOX (5) TO P-VOL (5).                                   C2802
           IF OPFLAG = '-'
               MOVE CH8F TO P-VOL (6),          ELSE
                   MOVE CH8 TO P-VOL (6).
04220      MOVE CH9 TO P-VOL (7).                                       C2802
04230      MOVE CHA TO P-VOL (8).                                       C2802
04330  READ-LOOX-RESUME.                                                C2802
04340      MOVE ZERO TO R-V.                                            C2802
04350      IF VOX (3) NOT = 0.0
04360          COMPUTE R-V = VOX (1) / VOX (3).                         C2802
04370      WRITE PRT AFTER 1.                                           C2802
04380      ADD 1 TO LINCNT.                                             C2802
04390      IF LINCNT GREATER THAN 52 GO TO W-HD-1.
04400      GO TO READ-LOOX.                                             C2802
04410                                                                   C2802
04420  READ-SEMI-RAW.                                                   C2802
04430      OPEN INPUT TAPIN WITH NO REWIND.                             C2802
04440      READ TAPIN INTO PRT6HA AT END STOP RUN.                      C2802
04450      READ TAPIN INTO PRT6HB AT END STOP RUN.                      C2802
04460      READ TAPIN INTO PRT6HC AT END STOP RUN.                      C2802
04470  SEMI-RAW-HEAD.                                                   C2802
04480      WRITE PRT FROM PRT6H AFTER 0.
04490      MOVE 5 TO LINCNT.                                            C2802
04500      WRITE PRT FROM PRTH AFTER 2.                                 C2802
05010      MOVE SPACE TO PRT.                                           C2802
05020      WRITE PRT AFTER 1.                                           C2802
05030      IF OPT = 7 GO TO READ-LOOP.                                  C2802
05040  SEMI-RAW-PRINT.                                                  C2802
05045      MOVE SPACE TO PRT.
05050      READ TAPIN INTO PRT7 AT END STOP RUN.                        C2802
05060      READ TAPIN INTO PRT8 AT END STOP RUN.                        C2802
05070      READ TAPIN INTO PRT9 AT END STOP RUN.                        C2802
05075      IF PRT7 = '*' MOVE '*' TO ASTSW.
05080      WRITE  PRT AFTER 1.                                          C2802
05090      ADD 1 TO LINCNT.                                             C2802
05100      IF ASTSW = '*' GO TO END-SEMI-RAW-CTL.
05110      IF LINCNT GREATER THAN 52 GO TO SEMI-RAW-HEAD.
05120      GO TO SEMI-RAW-PRINT.                                        C2802
```

4 - UTILITY DUMP PROGRAM (cont'd)

```
05130  END-SEMI-RAW-CTL.
05140      IF LINCNT GREATER THAN 50 GO TO W-HD-2.                    C2802
05150      GO TO READ-LOOP.                                           C2802
05160  READ-RAW.                                                      C2802
05170      ENTER LINKAGE.                                             C2802
05180      CALL 'RHDR' USING PRT6H1.                                  C2802
05190      ENTER COBOL.                                               C2802
05200      OPEN INPUT TAPIN WITH NO REWIND.                           C2802
05210      WRITE PRT FROM PRT6H AFTER 1.                              C2802
05220      GO TO COMMON-PRINT.                                        C2802
05230                                                                 C2802
05240  READ-LOOP-1.                                                   C2802
05250      READ TAPIN INTO PRT7 AT END STOP RUN.                      C2802
05260      READ TAPIN INTO PRT8 AT END STOP RUN.                      C2802
05270      READ TAPIN INTO PRT9 AT END STOP RUN.                      C2802
05280      IF OPT = 2 OR OPT = 3                                      C2802
05290          WRITE TAPOT-REC FROM PRT4,                             C2802
05300          WRITE TAPOT-REC FROM PRT5.                             C2802
05310      MOVE PRT6 TO PRT6H1.                                       C2802
05320      WRITE PRT FROM PRT6H AFTER 0.                              C2802
05330      ADD 2 TO LINCNT.                                           C2802
05340      PERFORM READ-LOOP-2.                                       C2802
05350  COMMON-PRINT.
05360      MOVE SPACE TO PRT.                                         C2802
05370      WRITE PRT AFTER 1.                                         C2802
05380      WRITE PRT FROM PRTH AFTER 2.                               C2802
05390      MOVE SPACE TO PRT.                                         C2802
05400      WRITE PRT AFTER 1.                                         C2802
           ADD 4 TO LINCNT.                                           C2802
05410      GO TO READ-LOOP.
05420  READ-LOOP-2.                                                   C2802
05430      MOVE SPACE TO PRT.                                         C2802
05440      READ TAPIN INTO PRT7 AT END STOP RUN.                      C2802
05450      READ TAPIN INTO PRT8 AT END STOP RUN.                      C2802
05460      READ TAPIN INTO PRT9 AT END STOP RUN.                      C2802
           IF PRT7 = '*' MOVE '*' TO ASTSW.                           C2802
05470      WRITE  PRT AFTER 1.
           ADD 1 TO LINCNT.                                           C2802
           IF LINCNT GREATER THAN 45 PERFORM W-HD-2.
           IF ASTSW NOT = '*'
               GO TO READ-LOOP-2.
05480      NOTE  * * *  END OF PERFORMED ROUTINE * * *.
05490  READ-LOOP.                                                     C2802
05500      IF FLAG-INT = 1 GO TO END-FILE.                            C2802
06010      READ TAPIN AT END GO TO END-FILE.                          C2802
06020      IF OPT = 2 GO TO WR-TAPE.                                  C2802
06030      MOVE SPACE TO PRT.                                         C2802
06040      ADD 1 TO CNT.  MOVE CNT TO REC.                            C2802
06050      IF CNT NOT GREATER THAN CPBYP                              C2802
06060          GO TO READ-LOOP.                                       C2802
06070      IF CNT GREATER THAN OPCNT GO TO END-FILE.                  C2802
06080      MOVE TRK TO P-TRK.                                         C2802
06090      MOVE TIME TO P-TIME.                                       C2802
06100      MOVE VOL (1) TO P-VOL (1).                                 C2802
06110      MOVE VOL (2) TO P-VOL (2).                                 C2802
06120      MOVE VOL (3) TO P-VOL (3).                                 C2802
                                                                      C2802

06130      MOVE VOL (4) TO P-VOL (4).                                 C2802
06140      MOVE VOL (5) TO P-VOL (5).                                 C2802
06150      MOVE VOL (6) TO P-VOL (6).                                 C2802
06160      MOVE VOL (7) TO P-VOL (7).                                 C2802
06170      MOVE VOL (8) TO P-VOL (8).                                 C2802
06180      MOVE ZERO TO R-V.                                          C2802
06190      IF VOL (3) NOT = ZERO                                      C2802
06200          COMPUTE R-V = VOL (4) / VOL (3).                       C2802
06210      WRITE PRT AFTER 1.                                         C2802
06220      ADD 1 TO LINCNT.                                           C2802
06230      IF LINCNT NOT GREATER THAN 52
06240          GO TO W-HD-3.                                          C2802
06250  W-HD-2.                                                        C2802
06260      WRITE PRT FROM PRT6H AFTER 0.                              C2802
06270      WRITE PRT FROM PRTH AFTER 2.                               C2802
06280      MOVE  3   TO LINCNT.
06290      MOVE SPACE TO PRT.                                         C2802
06300      WRITE PRT AFTER 1.                                         C2802
06310  W-HD-3.                                                        C2802
06320      IF OPT = 1 GO TO READ-LOOP.                                C2802
06330      IF OPT = 5 GO TO READ-LOOP.                                C2802
06340      IF OPT = 6 GO TO READ-LOOP.                                C2802
06350      IF OPT = 7 GO TO READ-LOOP.                                C2802
06360  WR-TAPE.                                                       C2802
06370      MOVE TRK TO TRK-O.                                         C2802
06380      MOVE TIME TO TIME-C.                                       C2802
06390      MOVE '1 ' TO DAY-C.                                        C2802
06400      MOVE 1 TO X1.                                              C2802
06410      PERFORM MOXE-VOL 8 TIMES.                                  C2802
06420      WRITE TAPOT-REC.                                           C2802
06430      GO TO READ-LOOP.                                           C2802
06440  END-FILE.                                                      C2802
06450      IF OPT = 2 OR OPT = 3 CLOSE TAPOT WITH NO REWIND.          C2802
06460      IF OPT = 4 OR OPT = 8 OR OPT = 9
06465          CLOSE TAPIX WITH NO REWIND.
06470      IF OPT NOT = 4 AND OPT NOT = 8
06475          CLOSE TAPIN WITH NO REWIND.
06480                              CLOSE PRTF.                        C2802
06490      IF OPT NOT = 9   STOP RUN.
           ENTER LINKAGE. CALL 'NCTPMK' USING BSR. ENTER COBOL.
           ENTER LINKAGE. CALL 'NCTPMK' USING BSR. ENTER COBOL.
           ENTER LINKAGE. CALL 'NCTPMK' USING BSR. ENTER COBOL.
06490      STOP RUN. .                                                C2802
06500  MOXE-VOL.                                                      C2802
07010      MOVE VOL (X1) TO VOL-O (X1).                               C2802
07020      ADD 1 TO X1.                                               C2802
// EXEC ASSEMBLY
         TITLE 'READ 1 80 CHARACTER RECORD'
         PRINT NOGEN
RHDR     START
         USING *,15
         STM  14,12,12(13)
         L    2,0(1)
         LA   1,RCCB
         EXCP (1)
         WAIT (1)
```

4 - UTILITY DUMP PROGRAM (cont'd)

```
         MVC   C(8C,2),CD
         LM    14,12,12(13)
         BR    14
RCCW     CCW   7,CD,C,8C
RCCB     CCB   SYSC11,RCCW
CD       DS    CL8C
         LTORG
INT      CSECT
         USING *,15
         STM   14,12,12(13)
         L     1,C(1)
         ST    1,SAV1
         STXIT OC,CAP,SAVE
         LM    14,12,12(13)
         BR    14
SAVE     DS    9D
SAV1     DS    F
         LTORG
CAP      BALR  15,C
         USING *,15
         L     1,=A(SAV1)
         L     1,C(1)
         MVI   C(1),241
         EXIT  OC
         LTORG
         END
```

5 - AVERAGE ZERO SCANS PROGRAM

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```
// EXEC COBOL                                                          C2765
010100 IDENTIFICATION DIVISION.                                        C2765
010200 PROGRAM-ID. 'C2765'.                                            C2765
010300 ENVIRONMENT DIVISION.                                           C2765
010400 INPUT-OUTPUT SECTION.                                           C2765
010500 FILE-CONTROL.                                                   C2765
010600     SELECT TAPIN ASSIGN 'SYS011' UTILITY 2400.                  C2765
010700     SELECT TAPOT ASSIGN 'SYS012' UTILITY 2400.                  C2765
010800     SELECT PRTOT ASSIGN 'SYS005' UNIT-RECORD 1403.              C2765
010905     SELECT CARDIN ASSIGN 'SYS007' UNIT-RECORD 2540R.            C2765
011000 DATA DIVISION.                                                  C2765
011100 FILE SECTION.                                                   C2765
011200 FD  TAPIN RECORDING MODE F, BLOCK CONTAINS 120 RECORDS.         C2765
011300     LABEL RECORDS ARE OMITTED, DATA RECORD IS IP.               C2765
011400 01  IP.                                                         C2765
011500     03  REC1.                                                   C2765
011600         05 TRK-NO              PICTURE XX.                      C2765
011700         05 FILLER              PICTURE X(4).                    C2765
011800         05 RPM                 PICTURE S999.
               05  RPMX REDEFINES RPM  PICTURE XXX.                    C2765
011900         05 HP                  PICTURE S999.                    C2765
012000         05 VS                  PICTURE S999.                    C2765
012100         05 FILLER              PICTURE X(3).                    C2765
012200         05 DAY                 PICTURE X.                       C2765
012300         05 FILLER              PICTURE X(8).                    C2765
012400         05  CODE               PICTURE X(3).                    C2765
012500 FD  TAPOT  RECORDING MODE F, BLOCK CONTAINS 120 RECORDS.        C2765
012600     LABEL RECORDS ARE OMITTED, DATA RECORD IS OP.               C2765
012700 01  OP.                                                         C2765
012800     03  OP1.                                                    C2765
012900         05  OP1-2              PICTURE XX.                      C2765
013001         05  OP-3               PICTURE X(4).                    C2765
013102         05  OP-RPM             PICTURE S9(3).                   C2765
013203         05  OP-HP              PICTURE S9(3).                   C2765
013304         05  OP-VS              PICTURE S9(3).                   C2765
013405         05  FILLER             PICTURE X(12).                   C2765
013506         05  OP-2P              PICTURE X(3).                    C2765
013600 FD  PRTOT  RECORDING MODE F.                                    C2765
013700     LABEL RECORDS ARE OMITTED, DATA RECORD IS PRT.              C2765
013800 01  PRT.                                                        C2765
013900     03  PRT1.                                                   C2765
014000         05  FILLER             PICTURE X.                       C2765
014100         05  PLIT1              PICTURE X(5).                    C2765
014200         05  FILLER             PICTURE XX.                      C2765
014300         05  FTRK-NO            PICTURE XX.                      C2765
014400         05  FILLER             PICTURE X(4).                    C2765
014500         05  PLIT2              PICTURE X(3).                    C2765
014600         05  FILLER             PICTURE XX.                      C2765
014700         05  PDAY               PICTURE X.                       C2765
014800         05  FILLER             PICTURE X(10).                   C2765
014900         05  PLIT3              PICTURE X(4).                    C2765
015000         05  FILLER             PICTURE XX.                      C2765
020100         05  PFILE-NO           PICTURE XX.                      C2765
020200         05  FILLER             PICTURE X(4).                    C2765
020300         05  P-DATE             PICTURE X(18).                   C2765
020400         05  FILLER             PICTURE X(73).
```

```
020500     03  PRT2 REDEFINES PRT1.                                    C2765
020600         05  FILLER             PICTURE X.                       C2765
020700         05  [illegible]        PICTURE 9(5).                    C2765
020800         05  FILLER             PICTURE XX.                      C2765
020900         05  PLIT4              PICTURE X(15).                   C2765
021000         05  FILLER             PICTURE X(110).                  C2765
021101 FD  CARDIN  RECORDING MODE F, RECORD CONTAINS 80 CHARACTERS.    C2765
021202             LABEL RECORDS ARE OMITTED, DATA RECORD IS CRD.      C2765
021303 01  CRD.                                                        C2765
021404     03  C-TRK-DAY          PICTURE X(3).
021505     03  RPMIC              PICTURE X.                           C2765
021606     03  NUMREC             PICTURE S9999.                       C2765
02170      03  FILLER   PICTURE X.                                     C2765
02180      03  N-TRK-DAY      PICTURE X.
021905     03  FILLER             PICTURE X.
021905     03  OPT-HP             PICTURE X.
021905     03  FILLER             PICTURE X(67).                       C2765
022000 WORKING-STORAGE SECTION.                                        C2765
022100 77  LIT1  PICTURE X(5) VALUE 'TRUCK'.                           C2765
022200 77  LIT2  PICTURE X(3) VALUE 'DAY'.                             C2765
022300 77  LIT3  PICTURE X(4) VALUE 'FILE'.                            C2765
022400 77  LIT4A  PICTURE X(15) VALUE 'RECORDS READ   '.               C2765
022500 77  LIT4B  PICTURE X(15) VALUE 'RECORDS WRITTEN'.               C2765
022600 77  LIT4C  PICTURE X(15) VALUE 'GOOD RECORDS   '.               C2765
022700 77  LIT4D  PICTURE X(15) VALUE 'ZERO RECORDS   '.               C2765
022800 77  Z-REC-COUNT          PICTURE 9(5) VALUE ZERO.               C2765
022901 77  ZCOUNT               PICTURE 9(5) VALUE ZERO.               C2765
023000 77  W-REC-COUNT          PICTURE 9(5) VALUE ZERO.               C2765
023100 77  G-REC-COUNT          PICTURE 9(5) VALUE ZERO.               C2765
023200 77  SKIP                 PICTURE 999 COMPUTATIONAL VALUE 012.   C2765
023300 77  FIRST-SW             PICTURE 9 VALUE 0.                     C2765
023400 77  HTRK-NO              PICTURE XX.                            C2765
023500 77  R-REC-COUNT          PICTURE 9(5) VALUE ZERO.               C2765
023600 77  END-SW               PICTURE 9 VALUE ZERO.                  C2765
023701 77  F-COUNT              PICTURE 99 VALUE 01.                   C2765
023802 77  ZCNT                 PICTURE 9V999 VALUE 1.000.             C2765
023900 77  HDAY                 PICTURE X.                             C2765
024001 77  A                    PICTURE 9(5).                          C2765
024102 77  DIF                  PICTURE S9(3).                         C2765
024203 77  JC-CNT               PICTURE 99 VALUE ZERO.                 C2765
024305 77  H-ZCOUNT             PICTURE 9(5) VALUE ZERO.               C2765
024406 77  IP-REC               PICTURE X(30).                         C2765
024505 77  Z-REC                PICTURE X(30).                         C2765
024605 77  SWT                  PICTURE X VALUE '0'.                   C2765
024705 77  HDATE                PICTURE X(18).                         C2765
024800 01  HOLD-REC.                                                   C2765
024900       03 FILLER          PICTURE X(6).                          C2765
025000       03 HRPM            PICTURE S999.                          C2765
030100       03 HHP             PICTURE S999.                          C2765
030200       03 HVS             PICTURE S999.                          C2765
030300       03 HDATA           PICTURE X(12).                         C2765
030400       03 FILLER          PICTURE X(3).                          C2765
030501 01  H-TRK-DAY.                                                  C2765
030602     02  HT1          PICTURE XX.                                C2765
030703     02  HD1          PICTURE X.                                 C2765
030800 01  READ-CD.
```

5 - AVERAGE ZERO SCANS PROGRAM (cont'd)

```
C30901     C5  FILLER          PICTURE X.                          C2765
C31002     C5  CCL2-5C         PICTURE X(49).                      C2765
C31102     C5  FILLER          PICTURE X(30).                      C2765
C31203 C1  CD1.                                                    C2765
C31304     C3  CD2.                                                C2765
C31405         C5  CCL1-49.                                        C2765
C31506             C7  COL1-3.                                     C2765
C31607                 C9  CCL1-2  PICTURE XX.                     C2765
C31708                 C9  CCL3    PICTURE X.                      C2765
031809             C7  COL4-49.                                    C2765
C31909                 C9  FILLER  PICTURE X(45).                  C2765
C32009 .               C9  CCL49   PICTURF X.                      C2765
C3210C         C5  COL50-90        PICTURF X(41).                  C2765
C32201     C2  CD3 REDEFINES CD2.                                  C2765
C32302         C5  CLT1            PICTURF X(30).                  C2765
C32402         C5  CLT2            PICTURE X(30).                  C2765
C32504         C5  OUT3            PICTLPE X(30).                  C2765
C3260C PRCCECLRE CIVISION.                                         C2765
C3270C     OPEN INPLT CARDIN, TAPIN WITH NC REWINC, OUTPUT PRTOT.  C2765
C3280C     MCVE SPACES TO PRT.                                     C2765
032905     MCVE ALL "O" TO Z-REC.                                  C2765
03300C READ-J-CARD.                                                C2765
C33108     REAC CARDIN AT END GC TC END-JCB.                       C2765
033205     PERFCRM CPEN-ROUTINE.                                   C2765
C33306     MCVE SPACES TO HCATE.                                   C2765
033407     ENTER LINKAGE.                                          C2765
033508     CALL "GETDAT" USING HDATE.                              C2765
C33608     ENTER COBOL.                                            C2765
C3370C READ-RECORD.                                                C2765
C3380C     ENTER LINKAGE.                                          C2765
C33901     CALL "HELP" USING READ-CC.                              C2765
C34002     ENTER CCBCL.                                            C2765
C34104     MCVE CCL2-5C TO COL1-49, MCVE SPACES TC COL50-90.       C2765
C34204     MCVE CCL1-2 TO HT1, MCVE CCL49 TC HC1.                  C2765
C34304     MCVE CCL1-2 TO HTRK-NO, MCVF CCL49 TO HDAY.             C2765
C3440C     IF N-TRK-DAY NOT = SPACE                                C2765
C3450C         MCVE N-TRK-DAY TC CCL49, HCAY.                      C2765
C34604     IF C-TRK-DAY NOT EQUAL TC H-TRK-CAY, GC TO J-ERRCR.     C2765
C34706     MCVE CLT1 TO OP, WRITE CP.                              C2765
C34806     MCVE CLT2 TO OP, WRITE CP.                              C2765
C34907     MCVE CLT3 TO OP, WRITE CF.                              C2765
C35007     ACC NUMREC TO R-REC-CCLNT.                              C2765
04010      IF NUMREC = ZERO GC TG CHECK-FIRST.                     C2765
040208     PERFORM SKIP-RECORDS THRU SKIP-EXIT NUMREC TIMES.       C2765
C4C305     GC TC CHECK-FIRST.                                      C2765
C4C40C SKIP-RECORDS.                                               C2765
C40501     REAC TAPIN AT END GO TC END-FILE.                       C2765
C4C602 SKIP-EXIT.                                                  C2765
C4C703 CHECK-FIRST.                                                C2765
C40804     REAC TAPIN AT END GO TC END-FILF.                       C2765
           IF RPM10 = "-" MCVE CODE TC RPPX.
C4C905     MCVE IP TO IP-REC.                                      C2765
C41CC6     ENTER LINKAGE.                                          C2765
041107     CALL "TRANZ" USING IP-RFC, SWT.                         C2765
C41208     ENTER CCBCL.                                            C2765
C41308     IF SWT = 1, MOVE 0 TO SWT, ACC 1 TC R-REC-CCLNT,        C2765
C41408         GC TC CHECK-FIRST.                                  C2765
041505     IF IP-REC = Z-REC, ADD 1 TC R-REC-CCUNT, GC TC CHECK-FIRST.  C2765
C41605         ELSE GO TC PROCESS-R.                               C2765
C4170C READ-TAPE.                                                  C2765
C4180C     REAC TAPIN AT END GC TC END-FILE.                       C2765
           IF RPM10 = "-" MOVE CCDE TC RPPX.
C41901     MCVE IP TC IP-REC.                                      C2765
C42002     ENTER LINKAGE.                                          C2765
C42103     CALL "TRANZ" USING IP-REC, SWT.                         C2765
C42204     ENTFR COBOL.                                            C2765
C42305 PRCCESS-R.                                                  C2765
C42408     MCVE 1 TO END-SW.                                       C2765
042505     IF SWT = 1, MOVE 0 TO SWT, ADD 1 TO R-REC-COUNT,        C2765
042605         GO TO READ-TAPE.                                    C2765
C4270C     IF IP-REC = Z-REC, GC TC ACC-Z-REC.                     C2765
C4280C     ACC 1 TC R-REC-CCUNT.                                   C2765
04290C     IF RPM IS NEGATIVE, COMPUTE RPM = RPM * -1.             C2765
04300C     IF HP IS NEGATIVE AND
               OPT-HP = SPACE
                   COMPUTE HP = HF * -1.
C4310C     IF VS IS NEGATIVE, COMPLTE VS = VS * -1.                C2765
043205     MOVE COL1-2 TO TRK-NO.                                  C2765
04330C     MOVE IP TO HOLD-REC, ACC 1 TC G-REC-COUNT.              C2765
043400     MOVE IP TO OP, WRITE OP, ADD 1 TC W-REC-COUNT.          C2765
04350C     GC TC READ-TAPE.                                        C2765
04360C ACC-Z-REC.                                                  C2765
04370C     ADD 1 TO Z-REC-COUNT, ADD 1 TO W-ZCOUNT.                C2765
043801 LCCP-REC.                                                   C2765
043905     ADC 1 TO R-REC-COUNT.                                   C2765
04400C     REAC TAPIN AT END GO TC END-FILE.                       C2765
           IF RPM10 = "-" MOVE CODE TC RPPX.
044101     MCVE IP TO IP-REC.                                      C2765
044202     ENTER LINKAGE.                                          C2765
044303     CALL "TRANZ" USING IP-REC, SWT.                         C2765
044404     ENTER COBOL.                                            C2765
044506     MOVE 1 TO END-SW.                                       C2765
044607     IF SWT = 1, MOVE 0 TO SWT, GC TC LCCP-REC.              C2765
04470C     IF IP-REC = Z-REC, GO TC ACC-Z-REC.                     C2765
04480C     ADD 1 TO R-REC-COUNT.                                   C2765
C44904 PROCESS-Z.                                                  C2765
045005     MOVE HOLD-REC TO OP, MCVE "0000" TO OP-3.               C2765
050106     MOVE "00" TO OP1-2.                                     C2765
050200     IF RPM IS NEGATIVE, COMPUTE RPM = RPM * -1.             C2765
           IF HP IS NEGATIVE AND
               OPT-HP = SPACE
                   COMPUTE HP = HF * -1.
05040C     IF VS IS NEGATIVE, COMPLTE VS = VS * -1.                C2765
C5050C     COMPLTE A = Z-REC-CCUNT + 1.                            C2765
05C60C     CCMPLTE DIF = RPM - HRPM.                               C2765
05070C     CCMPUTE OP-RPM ROUNDED = HRPM + DIF * (ZCNT / A).       C2765
05080C     CCMPUTE DIF = HP - HHP.                                 C2765
C50900     COMPLTE OP-HP ROUNDED = HHP + DIF * (ZCNT / A).         C2765
0510CC     CCMPLTE DIF = VS - HVS.                                 C2765
05110C     CCMPLTE OP-VS ROUNDED = HVS + DIF * (ZCNT / A).         C2765
C5120C     WRITE OP, ADD 1 TC W-REC-CCUNT, ADC 1.000 TC ZCNT.      C2765
C5130C     ACC 1 TC ZCOUNT.                                        C2765
```

5 - AVERAGE ZERO SCANS PROGRAM (cont'd)

```
051400     IF ZCOUNT = Z-REC-COUNT, GO TO FINI-Z, ELSE GO TO PROCESS-Z.    02765
051500 FINI-Z.                                                               02765
051605     MOVE COL1-Z TO TRK-NO.                                            02765
051700     MOVE IP TO HOLD-REC, MOVE IP TO OP, WRITE OP.                     02765
051801     ADD 1 TO W-REC-COUNT, MOVE 1.000 TO ZCNT.                         02765
051902     ADD 1 TO G-REC-COUNT, MOVE ZEROS TO Z-REC-COUNT.                  02765
052000     MOVE ZEROS TO ZCOUNT, GO TO READ-TAPE.                            02765
052101 J-ERROR.                                                              02765
052202     DISPLAY 'NO MATCH - JOB CANCELED' UPON CONSOLE.                   02765
052303     STOP RUN.                                                         02765
052400 PRINT-OUT.                                                            02765
052500     MOVE SPACES TO PRT, WRITE PRT AFTER ADVANCING 0.                  02765
052605     MOVE SPACES TO PRT.                                               02765
052700     MOVE LIT1 TO PLIT1, MOVE HTRK-NO TO PTRK-NO.                      02765
052800     MOVE LIT2 TO PLIT2, MOVE HDAY TO PDAY.                            02765
052900     MOVE LIT3 TO PLIT3, MOVE F-COUNT TO PFILE-NO.                     02765
053000     MOVE HDATE  TO P-DATE, WRITE PRT AFTER ADVANCING 2.               02765
053100     MOVE SPACES TO PRT, MOVE LIT4A TO PLIT4.                          02765
053200     MOVE R-REC-COUNT TO PNUM, WRITE PRT AFTER ADVANCING 2.            02765
053300     MOVE SPACES TO PRT, MOVE LIT4B TO PLIT4.                          02765
053400     MOVE W-REC-COUNT TO PNUM, WRITE PRT AFTER ADVANCING 2.            02765
053500     MOVE SPACES TO PRT, MOVE LIT4C TO PLIT4.                          02765
053600     MOVE G-REC-COUNT TO PNUM, WRITE PRT AFTER ADVANCING 2.            02765
053700     MOVE SPACES TO PRT, MOVE LIT4D TO PLIT4.                          02765
053800     MOVE H-ZCOUNT TO PNUM, WRITE PRT AFTER ADVANCING 2.               02765
053900 PRINT-OUT-EXIT.                                                       02765
054000 END-FILE.                                                             02765
054105     IF END-SW = 0, GO TO END-JOB, ELSE MOVE 0 TO END-SW.              02765
054200     PERFORM PRINT-OUT THRU PRINT-OUT-EXIT.                            02765
054300     SUBTRACT Z-REC-COUNT FROM Z-REC-COUNT.                            02765
054400     SUBTRACT G-REC-COUNT FROM G-REC-COUNT.                            02765
054500     SUBTRACT R-REC-COUNT FROM R-REC-COUNT.                            02765
054600     SUBTRACT W-REC-COUNT FROM W-REC-COUNT.                            02765
054705     SUBTRACT H-ZCOUNT FROM H-ZCOUNT.                                  02765
054806     SUBTRACT ZCOUNT FROM ZCOUNT, SUBTRACT JC-CNT FROM JC-CNT.         02765
054907     MOVE 1.000 TO ZCNT.                                               02765
055000     ADD 1 TO F-COUNT.                                                 02765
060100     CLOSE TAPOT WITH NO REWIND.                                       02765
060205     GO TO READ-J-CARD.                                                02765
060308 OPEN-ROUTINE.                                                         02765
060400     OPEN OUTPUT TAPOT WITH NO REWIND.                                 02765
060501     ENTER LINKAGE.                                                    02765
060602     CALL 'NOTPMK' USING SKIP.                                         02765
060703     ENTER COBOL.                                                      02765
060800 END-JOB.                                                              02765
060900     CLOSE TAPIN WITH NO REWIND, PRTOT, CARDIN.                        02765
061000     STOP RUN.                                                         02765
```

5 - AVERAGE ZERO SCANS PROGRAM (cont'd)

```
// EXEC ASSEMBLY
         TITLE 'STRIP ZONES FROM DATA'
         PRINT NOGEN
TRANZ    START
         USING *,15
         STM  14,12,12(13)
         L    5,0(1)
         L    6,4(1)
         TRT  0(30,5),TABLE
         BNZ  SETSW
         OC   0(30,5),=30C'0'
GO1      LM   14,12,12(13)
         BR   14
SETSW    MVI  0(6),C'1'
         B    GO1
TABLE    DC  192X'FF'
         DC   10X'00'
         DC   6X'FF'
         DC   10X'00'
         DC   22X'FF'
         DC   10X'00'
         DC   6X'FF'
         END
```

```
// EXEC ASSEMBLY
         TITLE 'READ 1 80 CHARACTER RECORD'
         PRINT NOGEN
RMCR     START
         USING *,15
         STM  14,12,12(13)
         L    2,0(1)
         LA   1,RCCB
         EXCP (1)
         WAIT (1)
         MVC  0(80,2),CD
         LM   14,12,12(13)
         BR   14
RCCW     CCW  2,CD,0,80
RCCB     CCB  SYS011,RCCW
CD       DS   CL80
         END
```

6 - PRINT ZERO DISTRIBUTION SUMMARY - PUNCH ES CARD FOR CALIBRATION

```
// EXEC ASSEMBLY
        ICTL 1,71,21
01010A2791     TITLE 'EPA COUNT GOOD-ZERO REC DISTRIBUTION   120210ABC'     A2791
01020          PRINT NOGEN                                                  A2791
01025A2791     START X'2100'
01030          ENTER R12,R0                                                 A2791
01040          USING T1,R11                                                 A2791
01050          LA    R13,=5D'0'                                             A2791
01060          CALL  GETDAT,(DATE)                                          A2791
01070          LA    R1,RCCB                                                A2791
01080          EXCP  (R1)                                                   A2791
01090          WAIT  (R1)                                                   A2791
01100          PACK  FILES,CD(4)                                            A2791
01110NEW       MVI   CC,X'8B'                                               A2791
01120          CP    FILES,FC                                               A2791
01130          BE    EOJ2                                                   A2791
01140          AP    FC,=P'1'                                               A2791
01150          BAL   R9,WLST                                                A2791
01160          XC    PR,PR                                                  A2791
01170          MVC   CNTS(48),=16PL3'0'                                     A2791
01180          BAL   R9,RSYS011                                             A2791
01190          MVI   CC,17                                                  A2791
01200          MVC   PR(5),=C'TRUCK'                                        A2791
01210          MVC   PR+6(2),T1                                             A2791
01220          MVC   PCTRK,T1                                               A2791
01230          MVC   TRK,T1                                                 A2791
01240          MVC   PR+10(3),=C'DAY'                                       A2791
01250          MVC   PR+14(1),T1+48                                         A2791
01260          MVC   PCDAY,T1+48                                            A2791
01270          MVC   DAY,T1+48                                              A2791
01280          MVC   PR+55(18),DATE                                         A2791
01290          BAL   R9,WLST                                                A2791
01300          XC    PR,PR                                                  A2791
01310          MVI   CC,9                                                   A2791
01320          BAL   R9,RSYS011                                             A2791
01330          BAL   R9,RSYS011                                             A2791
01340          SPACE                                                        A2791
01350READ      BAL   R9,RSYS011                                             A2791
01360          AP    RC,=P'1'                                               A2791
01370          BAL   R9,WLST1                                               A2791
01380          CLC   T1(2),=C'OC'                                           A2791
01390          BE    ZERO                                                   A2791
01400          CP    ZC,=P'0'                                               A2791
01410          BNE   DUMP                                                   A2791
01420ADDG      AP    GC,=P'1'                                               A2791
01430          B     READ                                                   A2791
01440ZERO      AP    ZC,=P'1'                                               A2791
01450          B     READ                                                   A2791
01460DUMP      OI    GC+3,15                                                A2791
01470          OI    ZC+3,15                                                A2791
01480          MVC   PR(5),=C'GOOD='                                        A2791
01490          UNPK  PR+5(5),GC                                             A2791
01500          MVC   PR+12(5),=C'ZERO='                                     A2791
02010          UNPK  PR+17(5),ZC                                            A2791
02020          BAL   R9,WLST                                                A2791
02030          AP    TG,GC                                                  A2791
```

```
02040          AP    TZ,ZC                                                  A2791
02050          CP    GC,=P'0'                                               A2791
02060          BE    *+10                                                   A2791
02070          AP    NG,=P'1'                                               A2791
02080          CP    ZC,=P'0'                                               A2791
02090          BE    *+10                                                   A2791
02100          AP    NZ,=P'1'                                               A2791
02110          SPACE 2                                                      A2791
02120          CP    ZC,=P'0'                                               A2791
02130          BE    CNTGRP                                                 A2791
02140          LA    R2,CNTS                                                A2791
02150          LA    R3,CRS                                                 A2791
02160CLP       CP    ZC,0(L'CRS,R3)                                         A2791
02170          BL    CADD                                                   A2791
02180          LA    R2,L'CNTS(R2)                                          A2791
02190          LA    R3,L'CRS(R3)                                           A2791
02200          B     CLP                                                    A2791
02210CADD      AP    0(L'CNTS,R2),=P'1'                                     A2791
02220CNTGRP    EQU   *                                                      A2791
02230          SPACE 2                                                      A2791
02240          ZAP   GC,=P'0'                                               A2791
02250          ZAP   ZC,=P'0'                                               A2791
02260          CLI   SW,0                                                   A2791
02270          BE    SW                                                     A2791
02280          MVI   CC,X'8B'                                               A2791
02290          BAL   R9,WLST                                                A2791
02300          MVI   CC,9                                                   A2791
02310SW        B     ADDG                                                   A2791
02320          B     EOJ1                                                   A2791
02330          SPACE                                                        A2791
02340EOJ       MVI   SW+1,0                                                 A2791
02350          B     DUMP                                                   A2791
02360EOJ1      XC    PR,PR                                                  A2791
02370          BAL   R9,WLST                                                A2791
02380          ZAP   CVB,TG                                                 A2791
02390          CP    NG,=P'0'                                               A2791
02400          BNE   DIVAG                                                  A2791
02410          ZAP   AG,TG                                                  A2791
02420          B     CKNZ                                                   A2791
02430DIVAG     EQU   *                                                      A2791
02440          DP    CVB,NG                                                 A2791
02450          ZAP   AG,CVB(4)                                              A2791
02460CKNZ      EQU   *                                                      A2791
02470          ZAP   CVB,TZ                                                 A2791
02480          CP    NZ,=P'0'                                               A2791
02490          BNE   DIVAZ                                                  A2791
02500          ZAP   AZ,TZ                                                  A2791
03010          B     CKOK                                                   A2791
03020DIVAZ     EQU   *                                                      A2791
03030          DP    CVB,NZ                                                 A2791
03040          ZAP   AZ,CVB(4)                                              A2791
03050CKOK      EQU   *                                                      A2791
03060          OI    TG+3,15                                                A2791
03070          OI    TZ+3,15                                                A2791
03080          OI    NG+3,15                                                A2791
03090          OI    NZ+3,15                                                A2791
```

6 - PRINT ZERO DISTRIBUTION SUMMARY (cont'd)

```
03100          OI    KC+3,15                                  A2791
03110          OI    AG+3,15                                  A2791
03120          OI    AZ+3,15                                  A2791
03130          UNPK  ZM1,KC                                   A2791
03140          UNPK  ZM2,TG                                   A2791
03150          UNPK  ZM3,TZ                                   A2791
03160          UNPK  ZM4,MG                                   A2791
03170          UNPK  ZM5,MZ                                   A2791
03180          UNPK  ZM6,AG                                   A2791
03190          UNPK  ZM7,AZ                                   A2791
03200          MVC   PR(25),ZM1                               A2791
03210          BAL   R9,bLST                                  A2791
03220          MVC   PR(25),ZM2                               A2791
03230          BAL   R9,bLST                                  A2791
03240          MVC   PR(25),ZM3                               A2791
03250          BAL   R9,bLST                                  A2791
03260          MVC   PR(25),ZM4                               A2791
03270          BAL   R9,bLST                                  A2791
03280          MVC   PR(25),ZM5                               A2791
03290           BAL   R9,bLST                                 A2791
03300          MVC   PR(25),ZM6                               A2791
03310            BAL   R9,bLST                                A2791
03320          MVC   PR(25),ZM7                               A2791
03330            BAL   R9,bLST                                A2791
03340*         AP    FC,=P'1'                                 A2791
03350*         CP    FC,=P'12'                                A2791
03360*         BE    EOJ2                                     A2791
03370          MVI   Sb+1,240                                 A2791
03380          SPACE 2                                        A2791
03390EOJ2A     MVI   CC,X'8B'                                 A2791
03400          BAL   R9,bLST                                  A2791
03410          XC    PR,PR                                    A2791
03420          MVI   CC,9                                     A2791
03430          MVC   PR+26(L'HD1),HD1                         A2791
03440          BAL   R9,bLST                                  A2791
03450          XC    PR,PR                                    A2791
03460          MVI   CC,17                                    A2791
03470          MVC   PR+20(L'HD2),HD2                         A2791
03480          BAL   R9,bLST                                  A2791
03490          XC    PR,PR                                    A2791
03500          MVI   CC,17                                    A2791
04010          MVC   PR+48(12),DATE                           A2791
04020          MVC   PR(L'HD6+L'TR+L'HD6B+L'DAY),HD6          A2791
04030          BAL   R9,bLST                                  A2791
04040          MVI   CC,9                                     A2791
04050          XC    PR,PR                                    A2791
04060          MVC   PR+11(L'HD3+L'HD3A),HD3                  A2791
04070          BAL   R9,bLST                                  A2791
04080          XC    PR,PR                                    A2791
04090          MVC   PR(L'HD4+L'HD4A+L'HD4B+L'HC4C+L'HC4C),HD4 A2791
04100          BAL   R9,bLST                                  A2791
04110          MVI   CC,17                                    A2791
04120          XC    PR,PR                                    A2791
04130          MVC   PR(L'HD5+2*L'HC5A+L'HD5B),HC5            A2791
04140          BAL   R9,bLST                                  A2791
04150          XC    PR,PR                                    A2791
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04160          MVI   CC,25                                    A2791
04170          EDIT  ED0,KC+1,PR+1                            A2791
04180          EDIT  ED0,TG+1,PR+12                           A2791
04190          ZAP   CVB,TG                                   A2791
04200          BAL   R9,CVSEC                                 A2791
04210          MVC   PR+19(10),SEC                            A2791
04220          EDIT  ED0,TZ+1,PR+42                           A2791
04230          ZAP   CVB,TZ                                   A2791
04240          BAL   R9,CVSEC                                 A2791
04250          MVC   PR+49(10),SEC                            A2791
04260          ZAP   CVB,TZ                                   A2791
04270          MP    CVB,=P'100000'                           A2791
04280          DP    CVB,KC                                   A2791
04290          AP    CVB(4),=P'5'                             A2791
04300          MVO   CVB(4),CVB(3)                            A2791
04310          EDIT  ED3,CVB+1,PR+70                          A2791
04320          CLI   PR+74,C' '                               A2791
04330          BNE   *+4+4+6                                  A2791
04340          MVI   PR+74,C'.'                               A2791
04350          OC    PR+75(2),=C'00'                          A2791
04360          SPACE 2                                        A2791
04370          OI    KC+L'KC-1,15                             A2791
04380          UNPK  PCCNT,KC                                 A2791
04390          OI    TZ+L'TZ-1,15                             A2791
04400          UNPK  PCTZ,TZ                                  A2791
04410          MVC   PCPCT,PR+72                              A2791
04420          OC    PCPCT(2),=2C'0'                          A2791
04423          CLI   DPRTSb+1,240
04427          BE    *+4+4
04430          BAL   R9,bPCH                                  A2791
04440          SPACE 2                                        A2791
04450          BAL   R9,bLST                                  A2791
04460          XC    PR,PR                                    A2791
04470          MVI   CC,9                                     A2791
04480          MVC   PR(L'HD7),HD7                            A2791
04490          BAL   R9,bLST                                  A2791
04500          XC    PR,PR                                    A2791
05010          MVI   CC,17                                    A2791
05020          MVC   PR(L'HD8),HD8                            A2791
05030          BAL   R9,bLST                                  A2791
05040          LA    R2,16                                    A2791
05050          LA    R3,CZS                                   A2791
05060          LA    R4,CNTS                                  A2791
05070LOOP      XC    PR,PR                                    A2791
05080          MVI   CC,17                                    A2791
05090          MVC   PR(L'CZS),0(R3)                          A2791
05100          MVC   PR+32(6),=X'402020202020'                A2791
05110          ED    PR+32(6),0(R4)                           A2791
05120          BAL   R9,bLST                                  A2791
05130          LA    R3,L'CZS(R3)                             A2791
05140          LA    R4,L'CNTS(R4)                            A2791
05150          BCT   R2,LOOP                                  A2791
05152DPRTSb    NOP   RESET
05154          MVI   DPRTSb+1,240
05156          B     EOJ1
05158RESET     MVI   DPRTSb+1,0
```

6 - PRINT ZERO DISTRIBUTION SUMMARY (cont'd)

```
05160          SPACE 2                                    A2791
05170          ZAP   TG,=P'0'                             A2791
05180          ZAP   TZ,=P'0'                             A2791
05190          ZAP   NC,=P'0'                             A2791
05200          ZAP   NG,=P'0'                             A2791
05210          ZAP   NZ,=P'0'                             A2791
05220          B     NEW                                  A2791
05230EOJ2      EQU   *
05240          MVI   CL,15                                A2791
05250          BAL   R9,WLST                              A2791
05260          MVI   PCTRK,C' '                           A2791
05270          MVC   PCTRK+1(75),PCTRK                    A2791
05280          BAL   R9,WPCH                              A2791
05290          MVI   CLPCH,15                             A2791
05300          BAL   R9,WPCH                              A2791
05310          EOJ                                        A2791
05320          SPACE 2                                    A2791
05330CVSEC     EQU   *                                    A2791
05340          MP    CVB,=P'0.88'                         A2791
05350          MVC   SECW(9),=X'402C2C2C202C4B2020'       A2791
05360          ED    SECW(9),CVB+4                        A2791
05370          AP    CVB,=P'50'                           A2791
05380          MVO   CVB,CVB(7)                           A2791
05390          MVC   CVB,CVB(7)                           A2791
05400          ZAP   CVW,CVB                              A2791
05410          DP    CVB,=PL4'3600'                       A2791
05420          UNPK  SECH,CVB(4)                          A2791
05430          OI    SECH+1,240                           A2791
05440          ZAP   CVB,CVB(4)                           A2791
05450          MP    CVB,=PL4'3600'                       A2791
05460          SP    CVW,CVB                              A2791
05470          DP    CVW,=PL4'60'                         A2791
05480          UNPK  SECM,CVW(4)                          A2791
05490          UNPK  SECS,CVW+4(4)                        A2791
05500          OI    SECM+1,240                           A2791
06010          OI    SECS+1,240                           A2791
06020          BR    R9                                   A2791
06030          SPACE 2                                    A2791
06040CNTS      DC    16PL3'0'                             A2791
06050          SPACE                                      A2791
06060HDR1      DC    C'DATA TAPE SUMMARY'                 A2791
06070HDR2      DC    C'SCAN COUNTS AND DISTRIBUTIONS'     A2791
06080HDL3      DC    C'-------- GOOD SCANS --------      '  A2791
06090HDL3A     DC    C'-------- ZERO SCANS --------'      A2791
06100HDL4      DC    CL20'  SCANS'                        A2791
06110HDL4A     DC    C'------- TIME -----'                A2791
06120HDL4B       DC    CL13' '                            A2791
06130HDL4C     DC    C'------- TIME -----'                A2791
06140HDL4D     DC    C'    PERCENT'                       A2791
06150HDL5      DC    CL11' READ'                          A2791
06160HDL5A     DC    2C' SCANS  SECONDS  HH.MM.SS         A2791
06170HDL5B     DC    C'ZERO'                              A2791
06180HDL6      DC    C'TRUCK '                            A2791
06190TMK       DC    C'XX'                                A2791
06200HDL6B     DC    C'  DAY '                            A2791
06210DAY       DC    C'X'                                 A2791
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06220HD7       DC    C'CONSECUTIVE     CORRESPONDING   NUMBER'   A2791
06230HD8       DC    C'ZERO SCANS      TIME - SECONDS  GROUPS '  A2791
06240          SPACE                                             A2791
06250CRS       DC    PL4'2,3,4,5,6,11,16,21,31,41'               A2791
06260          DC    PL4'51,61,71,101,1001,9999999'              A2791
06270          SPACE                                             A2791
06280CZS       DS    0CL29                                       A2791
06290          DC    C'        1                 .88   '         A2791
06300          DC    C'        2                1.76   '         A2791
06310          DC    C'        3                2.64   '         A2791
06320          DC    C'        4                3.52   '         A2791
06330          DC    C'        5                4.40   '         A2791
06340          DC    C'    6 - 10        5.28 - 8.80   '         A2791
06350          DC    C'   11 - 15        9.68 - 13.20  '         A2791
06360          DC    C'   16 - 20       14.08 - 17.60  '         A2791
06370          DC    C'   21 - 30       18.48 - 26.40  '         A2791
06380          DC    C'   31 - 40       27.28 - 35.20  '         A2791
06390          DC    C'   41 - 50       36.08 - 44.00  '         A2791
06400          DC    C'   51 - 60       44.88 - 52.80  '         A2791
06410          DC    C'   61 - 70       53.68 - 61.60  '         A2791
06420          DC    C'   71 - 100      62.48 - 88.00  '         A2791
06430          DC    C'  101 - 1000     88.88 - 880.00'          A2791
06440          DC    C'1001 - UP       880.88 - UP     '         A2791
06450          SPACE 2                                           A2791
06460RCCW      CCW   2,CD,0,80                                   A2791
06470RCCB      CCB   SYSIPT,RCCW                                 A2791
06480CD        DS    CL80                                        A2791
06490          SPACE                                             A2791
06500SECW      DC    C' '                                        A2791
07010SEC       DS    0CL18                                       A2791
07020SEC1      DC    CL8' '                                      A2791
07030          DC    C'  '                                       A2791
07040SECH      DC    C'XX'                                       A2791
07050          DC    C'.'                                        A2791
07060SECM      DC    C'XX'                                       A2791
07070          DC    C'.'                                        A2791
07080SECS      DC    C'XX'                                       A2791
07090          SPACE                                             A2791
07100EDC       DC    X'402020202020'                             A2791
07110ED3       DC    X'40202021 4B2020'                          A2791
07120DATE      DC    CL16' '                                     A2791
07130          SPACE 2                                           A2791
07140ZM1       DC    CL5' '                                      A2791
07150          DC    CL20'    SCANS READ'                        A2791
07160ZM2       DC    CL5' '                                      A2791
07170          DC    CL20' TOTAL GOOD'                           A2791
07180ZM3       DC    CL5' '                                      A2791
07190          DC    CL20' TOTAL ZERO'                           A2791
07200ZM4       DC    CL5' '                                      A2791
07210          DC    CL20' NUMBER GOOD GROUPS'                   A2791
07220ZM5       DC    CL5' '                                      A2791
07230          DC    CL20' NUMBER ZERO GROUPS'                   A2791
07240ZM6       DC    CL5' '                                      A2791
07250          DC    CL20' AVERAGE NUMBER GOOD'                  A2791
07260ZM7       DC    CL5' '                                      A2791
07270          DC    CL20' AVERAGE NUMBER ZERO'                  A2791
```

6 - PRINT ZERO DISTRIBUTION SUMMARY (cont'd)

```
C728CCVB      DS   D                                                        A2791
C729CCVW      DS   D                                                        A2791
C7300FILES    DC   PL4'0'                                                   A2791
07210FC       DC   PL4'0'                                                   A2791
C7320GC       DC   PL4'0'                                                   A2791
C733CZC       DC   PL4'0'                                                   A2791
C7340TG       DC   PL4'0'                                                   A2791
C7350TZ       CC   PL4'0'                                                   A2791
C7360NG       DC   PL4'0'                                                   A2791
C7370NZ       DC   PL4'0'                                                   A2791
C7380KC       CC   PL4'0'                                                   A2791
C7390AG       DC   PL4'0'                                                   A2791
C740CAZ       DC   PL4'0'                                                   A2791
07410CC       DS   CL1                                                      A2791
07420PR       DS   CL132                                                    A2791
C743CSS       DC   X'C1'                   ***                              A2791
C7440PCTRK    DC   C'XX'                    *                               A2791
C7450PCDAY    CC   C'X'                     *                               A2791
C7460         DC   C' '                     *                               A2791
07470PCCNT    CC   CL5' '                   *                               A2791
C7480         CC   C' '                     *                               A2791
C7490PCTZ     CC   CL5' '               *********                           A2791
C7500         DC   C'  '                 *******                            A2791
C8010PCPCT    CC   CL5' '                 *****                             A2791
C8C20         DC   CL56' '                 ***                              A2791
C8C30         DC   C'ES'                    *                               A2791
G8C40         LTCRG                                                         A2791
08C50WPCH     PC   R9,SYSPCH,SS,81,CLPCH                                    A2791
08C60WLST     PRTM  R9,SYSLST,CC,133,CV,CL,T1+7200,100,56                   A2791
08070RSYS011  RT   R9,SYS011,T1,P11,3C,3600,ECJ,,,0,0                       A2791
C8C80         DROP R8                                                       A2791
C8C90T1       DS   CL3C                                                     A2791
C8100         END                                                           A2791
```

6 - PRINT ZERO DISTRIBUTION SUMMARY (cont'd)

```
// EXEC ASSEMBLY                                                        GETDAT
         ICTL 1,71,21                                                   GETDAT
C1010DATE      TITLE 'CONVERT CONRG DATE TO ENGLISH    #EC'             GETDAT
C1020GETDAT    START 0                                                  GETDAT
01030          USING *,15                                               GETDAT
01040          STM  1,4,0(13)                                           GETDAT
01050          L    2,0(1)                                              GETDAT
01070          CGMRG                                                    GETDAT
01080*                                                                  GETDAT
01090*      R1 = DATE MM/DD/YY                                          GETDAT
01100*      R2 = DATE JANUARY 1, 1970       18 CHARACTERS               GETDAT
01110*      R3 = WORK                                                   GETDAT
01120*      R4 = WORK                                                   GETDAT
01130*                                                                  GETDAT
01150*                                                                  GETDAT
C1160*         LINKAGE                                                  GETDAT
01170*              CALL  GETDAT,(DATE)                                 GETDAT
01180*         USES STANDARD DOS LINKAGE                                GETDAT
01190*                                                                  GETDAT
01200EXP       PACK CVB,0(2,1)                                          GETDAT
C2010          CVB  3,CVB                                               GETDAT
C2020          BCTR 3,0                                                 GETDAT
02030          MH   3,=H'10'                                            GETDAT
02040          LA   4,0                                                 GETDAT
02050          IC   4,DTAB(3)                                           GETDAT
C2060          LA   3,DTAB+1(3)                                         GETDAT
C2070          EX   4,DMOVE                                             GETDAT
C2080          LA   2,2(4,2)                                            GETDAT
02090          CLI  3(1),240                                            GETDAT
02100          BE   DONE                                                GETDAT
02110          MVC  0(2,2),3(1)                                         GETDAT
02120          LA   2,2(2)                                              GETDAT
02130DONERT    MVC  0(4,2),=C', 19'                                     GETDAT
C2140          LA   2,4(2)                                              GETDAT
C2150          MVC  0(2,2),6(1)                                         GETDAT
C2160          LM   1,4,0(13)                                           GETDAT
C2170          BR   14                                                  GETDAT
C2180DONE      MVC  0(1,2),4(1)                                         GETDAT
C2190          LA   2,1(2)                                              GETDAT
C2200          B    DONERT                                              GETDAT
C3010DMOVE     MVC  0(0,2),0(3)                                         GETDAT
C3020CVB       DS   D                                                   GETDAT
03030DTAB      DC   X'06'                                               GETDAT
C3040          DC   CL9'JANUARY'                                        GETDAT
C3050          DC   X'07'                                               GETDAT
C3060          DC   CL9'FEBRUARY'                                       GETDAT
C3070          DC   X'04'                                               GETDAT
03080          DC   CL9'MARCH'                                          GETDAT
C3090          DC   X'04'                                               GETDAT
03100          DC   CL9'APRIL'                                          GETDAT
C3110          DC   X'02'                                               GETDAT
C3120          DC   CL9'MAY'                                            GETDAT
C3130          DC   X'03'                                               GETDAT
03140          DC   CL9'JUNE'                                           GETDAT
03150          DC   X'03'                                               GETDAT
C3160          DC   CL9'JULY'                                           GETDAT
```

```
C3170          DC   X'05'                                               GETDAT
C3180          DC   CL9'AUGUST'                                         GETDAT
03190          DC   X'08'                                               GETDAT
04010          DC   CL9'SEPTEMBER'                                      GETDAT
C4020          DC   X'06'                                               GETDAT
C4030          DC   CL9'OCTOBER'                                        GETDAT
04040          DC   X'07'                                               GETDAT
C4050          DC   CL9'NOVEMBER'                                       GETDAT
04060          DC   X'07'                                               GETDAT
04070          DC   CL9'DECEMBER'                                       GETDAT
C4080          END                                                      GETDAT
```

6 - PRINT ZERO DISTRIBUTION SUMMARY (cont'd)

```
// EXEC ASSEMBLY
I%         START 0
* COMPILEC 1C/10/72 (ABC)
           SPACE                                                              1
*          CALL  IC,(FUNCTION,LOGICAL-UNIT,MCDE,ADDRESS,LENGTH)
*                                        CF STATUS                            2
*                 FLACTION=         LOGICAL-UNIT=  MCDE=        STATUS        3
*                                                                             4
*                     1=READ         4=1                                      5
*                     2=WRITE        5=2         1=FORWARC     0=ALL-OK       6
*                     3=SENSE        6=3         2=EACKWARD    1=EOF          7
*                     4=TAPE MARK    7=4                                      8
*                     5=REWIND       8=5                                      9
*                     6=UNLOAD                                               10
*                     7=FSF                                                  11
*                     8=BSF                                                  12
*                                                                            13
*EXAMPLE TO READ   CALL IO,(READ,LOGICAL,MCDE,ADDRESS,LENGTH)                14
*EXAMPLE TO WRITE  CALL IO,(WRITE,LOGICAL,ACDRESS,LENGTH)                    15
*EXAMPLE TC SENSE  CALL IO,(SENSE,LOGICAL,INDICATCR)                         16
*EXAMPLE TO SENSE AND PASS LENGTH  CALL IC (SENSE,LOGICAL, IND,LENGTH)       17
*EXAMPLE TO WRITE END FILE  CALL IC,(ENDFILE,LCGICAL)                        18
*EXAMPLE TO REWIND   CALL IO,(REWIND,LOGICAL)                                19
*EXAMPLE TO UNLOAD   CALL IO(UNLOAD,LOGICAL)                                 20
*EXAMPLE TO FORWARD SKIP FILE   CALL IO (FSF,LOGICAL)                        21
* EXAMPLE TO BACKWARD SKIP FILE  CALL IO  (BSF,LOGICAL)                      22
*                                                                            23
*        REG.                                                                24
*          1=ACCR. OF PARAMETER LIST                                         25
*          2=WORK                                                            26
*          3=WORK                                                            27
*          4=ADDR. CF ROUTINE CALLED BY FUNCTICN.                            28
*          5=ADDR. CF LOGICAL-UNIT CCB.                                      29
*          6=ADDR. OF INDICATOR WHEN SENSE IS USED.                          30
         SPACE 3                                                             31
         USING *,15                                                          32
         SAVE  (14,12)
         L     2,4(1)           ADDR. CF FORTRAN UNIT NO. TC REG(2)          33
         L     3,C(2)           FORTRAN LAIT NC. TC REG(3)                   34
         S     3,CCA3                                                        35
         S     3,CON1                                                        36
         SLL   3,2                                                           37
         L     5,CCB(3)         MULTIPLY REG(3) BY 4                         38
         L     2,0(1)           LOADING REG(5) WITH ADDR. CF CCB.            39
         L     3,C(2)           ADDR. CF FUNCTION TO REG(2)                  4C
         S     3,CON1           LOADING FUNCTICN TC REG(3)                   41
         SLL   3,2                                                           42
         L     4,LOC(3)         MULTIPLY REG(3) BY 4                         48
         LR    2,1              LOADING REG(4) WITH ACCR. CF FUNC ROUTINE    44
         LR    1,5              SAVE R1                                      45
         TM    2(1),X'EC'       TRAFFIC BIT                                 133
         BO    *-8                                                          130
         SVC   7                                                            131
         LR    1,2                                                          132
         BR    4
                                                                             46
```

```
RETURN   SPACE
            MVI   12(13),X'FF'
         RETURN (14,12)
*                                                                            47
*                                                                            48
CON1     CC    F'1'                                                          49
         SPACE                                                               5C
LOC      DC    AL4(READ)
         CC    AL4(WRITE)
         CC    AL4(SENSE)                                                    51
         CC    AL4(ENDFILE)                                                  52
         DC    AL4(REWIND)                                                   53
         DC    AL4(UNLOAD)                                                   54
         CC    AL4(FSF)                                                      55
         DC    AL4(BSF)                                                      56
         SPACE                                                               57
CON3     DC    F'3'                                                          58
REG3     CC    F'C'
         SPACE
CCB      CC    AL4(CCB1)                                                     59
         CC    AL4(CCB2)
         DC    AL4(CCB3)
         DC    AL4(CCB4)                                                     60
         CC    AL4(CCB5)                                                     61
*                                                                            62
*                                                                            63
         DS    0D                                                            64
CCB1     DC    XL2'C'                                                        65
         CC    X'ECCC'        RESIDUAL CCUNT                                 66
         DC    XL2'C'         COMMUNICATICNS BYTES
         CC    AL1(1)         CSW STATUS BYTES                               67
         CC    AL1(1)         LOGICAL UNIT CLASS                             68
         DC    XL1'C'         LOGICAL UNIT NC.                               69
         DC    AL3(CCW1)                                                     7C
         CC    XL1'C'         CCW ADDRESS                                    71
         DC    AL3(C)         STATUS BYTE                                    72
CCW1     CCW   X'CC',C,X'OC',C      CSW CCW ADDRESS                          73
CCB2     CC    XL2'C'                                                        74
         CC    X'2CC0'
         DC    XL2'C'
         DC    AL1(1)                                                        75
         CC    AL1(2)                                                        76
         CC    XL1'C'                                                        77
         CC    AL3(CCW2)                                                     78
         DC    XL1'0'                                                        79
         CC    AL3(C)                                                        8C
CCW2     CCW   X'CC',C,X'CC',C                                               81
CCB3     CC    XL2'C'                                                        82
         DC    X'8C00'
         CC    XL2'C'
         DC    AL1(1)                                                        83
         DC    AL1(2)                                                        84
         CC    XL1'C'                                                        85
         CC    AL3(CCW3)                                                     86
         DC    XL1'C'                                                        87
         CC    AL3(C)                                                        88
                                                                             89
                                                                             9C
```

6 - PRINT ZERO DISTRIBUTION SUMMARY (cont'd)

```
CCW3     CCW   X'CC',C,X'CC',C
CCP4     DC    XL2'C'
         CC    X'8COG'
         DC    XL2'C'
         CC    AL1(1)
         CC    AL1(4)
         CC    XL1'C'
         DC    AL3(CCW4)
         DC    XL1'C'
         CC    AL3(C)
CCW4     CCW   X'CC',C,X'0G',C
CCD5     DC    XL2'0'
         DC    X'0000'
         CC    XL2'0'
         DC    AL1(1)
         CC    AL1(5)
         CC    XL1'0'
         DC    AL3(CCW5)
         DC    XL1'C'
         DC    AL3(0)
CCW5     CCW   X'C0',0,X'00',0
*
*
READ     L     2,8(1)           ADDR. CF MCDE TO REG(2).
         CLI   3(2),X'01'       FORWARD
         BE    FORWD
         MVI   16(5),X'0C'      BACKWARD REAC
         B     CKADDR
FORWD    MVI   16(5),X'02'      FORWARD REAC
CKADDR   MVC   17(3,5),13(1)    DATA ADDR. TO CCW.
         L     2,16(1)          ADDR. OF DATA LENGTH TO REG(2).
         MVC   21(3,5),1(2)     DATA LENGTH TO CCW.
         CLI   16(5),X'0C'
         MVC   REG3,16(5)
         BNE   EXEC1
         MVI   REG3,X'00'
         L     2,REG3
         MVC   REG3,20(5)
         MVI   REG3,X'00'
         L     3,REG3
         AR    2,3
         S     2,CON1
         ST    2,REG3
         MVC   17(3,5),REG3+1
EXEC1    LR    1,5              ADDR. CF CCB TO REG(1)
         SVC   C
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*        BEGIN CHANGE                                        *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
         CLI   16(5),X'1F'        * CHANGE MADE 10/16/72 (ABC)
         BNE   RETURN             * TC ISSUE WAIT IMMECIATELY
         TM    2(1),X'80'         * AFTER WRITE TAPEMARK
         BO    *+6                *
         SVC   7                  *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*        END CHANGE                                          *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
         B     RETURN
*
*
WRITE    MVC   17(3,5),9(1)     DATA ADCR. TC CCW
         L     2,12(1)          ADDR. CF DATA LENGTH TO REG(2).
         MVC   21(3,5),1(2)     DATA LENGTH TC CCW.
         MVI   16(5),X'C1'      WRITE CCDE TC CCW.
         B     EXEC1
*
*
REWIND   MVI   16(5),X'07'      REWIND CODE TO CCW.
         MVI   23(5),X'01'      LENGTH CF 1 TO CCW.
         B     EXEC1
*
*
UNLOAD   MVI   16(5),X'0F'
         MVI   23(5),X'C1'
         B     EXEC1
*
*
FSF      MVI   16(5),X'3F'
         MVI   23(5),X'01'
         B     EXEC1
*
*
BSF      MVI   16(5),X'2F'
         MVI   23(5),X'01'
         B     EXEC1
*
*
ENDFILE  MVI   16(5),X'1F'      TAPE MARK CCCE TC CCW.
         MVI   23(5),X'C1'      LENGTH CF 1 TC CCW.
         B     EXEC1
*
*
SENSE    L     6,8(1)           ADDR. CF INDICATCR IN REG(6)
CKBUSY   LR    1,5
         TM    4(5),X'C1'       UNIT EXCEPTICN
         BC    8,MKC
         L     2,CCN1
         ST    2,C(6)
         B     RETURN
MKC      SR    2,2
         ST    2,C(6)
         L     1,24(13)
         TM    8(1),X'8C'
         BO    RETURN
         L     2,8(5)           ADDR OF CCW
         LA    2,4(2)
         L     2,C(2)
         MVC   FFF+2(2),0(5)
         S     2,FFF
         L     1,12(1)
         ST    2,C(1)
         B     RETURN

*
*
FFF      DC    F'C'
         END
```

7 - LOAD CALIBRATION DATA PROGRAM

```
// PAUSE
// EXEC ASSEMBLY                                                        A2895
         ICTL 1,71,21                                                   A2895
C1040          PRINT NOGEN                                              A2895
C1050          TITLE ' EPA LOAD CTL CARDS ON SAMPLE DATA  12021OABC'    A2895
C1060          START X'2100'                                            A2895
C1070          ENTER R12                                                A2895
C1080          USING T1,R11                                             A2895
C1090          USING T2,R10                                             A2895
C1100          COMRG                                                    A2895
C1110          MVC  DATE,0(R1)                                          A2895
C1120          MVC  UPSISW,23(R1)                                       A2895
01123          BAL  R9,RSYSIPT                                          A2895
01127          MVC  CDM,CD                                              A2895
C1130CTAPE     BAL  R9,RSYSO12                                          A2895
C1140          BAL  R9,RSYSO11                                          A2895
C1150          MVC  CD(30),T1                                           A2895
C1160          BAL  R9,RSYSO11                                          A2895
C1170          MVC  CD+30(30),T1                                        A2895
C1180          BAL  R9,RSYSO11                                          A2895
C1190          MVC  CD+60(30),T1                                        A2895
C1200          MVC  TKID,CD                                             A2895
C1210          MVC  DAY,CD+48                                           A2895
01220          BAL  R9,OVFL                                             A2895
C1230          MVC  PR(80),CD                                           A2895
01240          BAL  R9,RSYSLST                                          A2895
01250          MVC  T2,CD                                               A2895
01260          BAL  R9,RSYSO12                                          A2895
C1270          MVC  T2,CD+30                                            A2895
C1280          BAL  R9,RSYSO12                                          A2895
C1290          MVC  T2,CD+60                                            A2895
C1300          BAL  R9,RSYSO12                                          A2895
C1303          MVC  CD(80),CDM                                          A2895
C1307          B    ACC+4                                               A2895
C1310ACC       BAL  R9,RSYSIPT                                          A2895
C1320          XC   PR,PR                                               A2895
C1330          MVI  CC,S                                                A2895
C1340          MVC  PR(80),CD                                           A2895
C1350          BAL  R9,RSYSLST                                          A2895
C1360          MVC  T2,CD                                               A2895
C1370          BAL  R9,RSYSO12                                          A2895
C1380          MVC  T2,CD+30                                            A2895
C1390          BAL  R9,RSYSO12                                          A2895
C1400          MVC  T2,CD+60                                            A2895
C1410          BAL  R9,RSYSO12                                          A2895
C1420          CLI  CW,C                                                A2895
C1430          BE   *+8                                                 A2895
C1440          BAL  R9,OVFL                                             A2895
01450          CLI  CD,C'*'                                             A2895
C1460          BE   COPY                                                A2895
C1470          CLC  LAST,=C'**'                                         A2895
C1480          BE   CK3                                                 A2895
C1490          CLC  LAST,=C' 3'                                         A2895
C1500          BE   CK4                                                 A2895
C2010          CLC  LAST,=C' 4'                                         A2895
C2020          BE   CK5                                                 A2895
```

```
C2030          CLC  LAST,=C' 5'                                         A2895
C2040          BE   CKGR                                                A2895
C2050          CLC  LAST,=C'GR'                                         A2895
C2060          BE   CKES                                                A2895
C2070          CLC  LAST,=C'ES'                                         A2895
               BE   CKMM
               CLC  LAST,=C'MM'
C2140          BE   CKM4
               CLC  LAST,=C'M4'
               BE   CKMM4
C2150          B    CANCEL                                              A2895
C2160          SPACE                                                    A2895
02170CK3       CLI  CD+79,243                                           A2895
C2180          BNE  CANCEL                                              A2895
C2190          MVC  LAST,=C' 3'                                         A2895
C2200          B    ACCEPT                                              A2895
C2210          SPACE                                                    A2895
C2220CK4       CLI  CD+79,244                                           A2895
C2230          BNE  CANCEL                                              A2895
C2240          MVC  LAST,=C' 4'                                         A2895
C2250          B    ACCEPT                                              A2895
C2260          SPACE                                                    A2895
C2270CK5       CLI  CD+79,245                                           A2895
C2280          BNE  CANCEL                                              A2895
C2290          MVC  LAST,=C' 5'                                         A2895
C2300          B    ACCEPT                                              A2895
02310          SPACE                                                    A2895
C2320CKGR      CLC  CD+78(2),=C'GR'                                     A2895
C2330          BNE  CANCEL                                              A2895
C2340          MVC  LAST,=C'GR'                                         A2895
C2350          B    ACCEPT                                              A2895
C2360          SPACE                                                    A2895
C2370CKES      CLC  CD+78(2),=C'GR'                                     A2895
02380          BE   ACCEPT                                              A2895
C2390          CLC  CD+78(2),=C'ES'                                     A2895
C2400          BNE  CANCEL                                              A2895
C2410          MVC  LAST,=C'ES'                                         A2895
C2420          B    ACCEPT                                              A2895
C2430          SPACE                                                    A2895
C2440CKMM      CLC  CD+78(2),=C'MM'                                     A2895
C2450          BNE  CANCEL                                              A2895
C2460          MVC  LAST,=C'MM'                                         A2895
C2470          B    ACCEPT                                              A2895
C2480          SPACE                                                    A2895
C2490CKHM      CLC  CD+78(2),=C'HM'                                     A2895
C2500          BNE  CANCEL                                              A2895
C3010          MVC  LAST,=C'HM'                                         A2895
C3020          B    ACCEPT                                              A2895
03030          SPACE                                                    A2895
C3040CKM4 .    CLC  CD+78(2),=C'MM'
C3050     BE   ACCEPT                                                   A2895
C3060          CLC  CD+78(2),=C'M4'                                     A2895
C3070          BNE  CANCEL                                              A2895
C3080          MVC  LAST,=C'M4'                                         A2895
C3090          B    ACCEPT                                              A2895
C3100          SPACE                                                    A2895
```

7 - LOAD CALIBRATION DATA (cont'd)

```
[illegible]   CLC   [illegible]                                          A2895
[illegible]   [illegible] CANCEL                                         A2895
[illegible]   [illegible] ACCEPT                                         A2895
03140ACC[illegible] EQU   *                                              A2895
03150         CLC   [illegible](3),CC                                    A2895
03160         BNE   CANCEL                                               A2895
03170               [illegible]                                          A2895
03180         SPACE 2                                                    A2895
03190COPY     EQU   *                                                    A2895
03200         CLC   LAST,=C'P4'                                          A2895
03210         BNE   CANCEL                                               A2895
03220         MVC   LAST,=C'**'                                          A2895
03230         MVI   CC,27                                                A2895
03240         XC    PR,PR                                                A2895
03250         BAL   R9,WSYSLST                                           A2895
03260         SPACE 2                                                    A2895
03270         TM    LPSISW,X'80'                                         A2895
03280         BZ    RTAPE                                                A2895
03290         MVI   CC,9                                                 A2895
03300         MVI   PR,C'*'                                              A2895
03310         MVC   PR+1(131),PR                                         A2895
03320         MVC   PR+30(32),=CL32'OLD CONTROL DATA BEING DELETED'      A2895
              BAL   R9,WSYSLST                                           A2895
03330         LA    R2,7                                                 A2895
03340         XC    PR,PR                                                A2895
03350DROP     BAL   R9,RSYSO11                                           A2895
03360         MVC   PR(30),T1                                            A2895
03370         BAL   R9,RSYSO11                                           A2895
03380         MVC   PR+30(30),T1                                         A2895
03390         BAL   R9,RSYSO11                                           A2895
03400         MVC   PR+60(30),T1                                         A2895
03410         BAL   R9,WSYSLST                                           A2895
03420         BCT   R2,DROP                                              A2895
03430         SPACE 2                                                    A2895
03440         XC    PR,PR                                                A2895
03450         BAL   R9,WSYSLST                                           A2895
03460RTAPE    BAL   R9,RSYSO11                                           A2895
03470         BAL   R9,WSYSLST1                                          A2895
03480         AP    RCNT,=P'1'                                           A2895
03490         MVC   T2,T1                                                A2895
03500         CLC   T1(2),=C'00'                                         A2895
04010         BNE   *+10                                                 A2895
04020         AP    ZCNT,=P'1'                                           A2895
04030         BAL   R9,WSYSO12                                           A2895
04040         AP    WCNT,=P'1'                                           A2895
04050         B     RTAPE                                                A2895
04060CANCEL   MVI   CLSYSLST,15
              BAL   R9,WSYSLST
              CANCEL
04070ENDTP    MVI   CL,15                                                A2895
04080         BAL   R9,WSYSO12                                           A2895
04090         XC    PR,PR                                                A2895
04100         MVI   CC,17                                                A2895
04110         BAL   R9,WSYSLST                                           A2895
04120         OI    RCNT+L'RCNT-1,15                                     A2895
04130         UNPK  PR(7),RCNT                                           A2895
```

```
04140         MVC   PR+9(25),=CL25'RECORDS READ'                         A2895
04150         BAL   R9,WSYSLST                                           A2895
04160         OI    ZCNT+L'ZCNT-1,15                                     A2895
04170         UNPK  PR(7),ZCNT                                           A2895
04180         MVC   PR+9(25),=CL25'ZERO RECORDS ON OUTPUT'               A2895
04190         BAL   R9,WSYSLST                                           A2895
04200         OI    WCNT+L'WCNT-1,15                                     A2895
04210         UNPK  PR(7),WCNT                                           A2895
04220         MVC   PR+9(25),=CL25'RECORDS WRITTEN'                      A2895
04230         BAL   R9,WSYSLST                                           A2895
04240         ZAP   RCNT,=P'0'                                           A2895
04250         ZAP   ZCNT,=P'0'                                           A2895
04260         ZAP   WCNT,=P'0'                                           A2895
04263         BAL   R9,RSYSIPT                                           A2895
04267         MVC   CDH,CD                                               A2895
04270         B     ETAPE                                                A2895
04280         SPACE 2                                                    A2895
04290OVFL     MVI   CC,X'8B'                                             A2895
04300         LR    R0,R9                                                A2895
04310         BAL   R9,WSYSLST                                           A2895
04320         XC    PR,PR                                                A2895
04330         MVI   CC,9                                                 A2895
04340         MVC   PR+00(5),=C'TRUCK'                                   A2895
04350         MVC   PR+06(2),TKID                                        A2895
04360         MVC   PR+10(3),=C'DAY'                                     A2895
04370         MVC   PR+14(1),DAY                                         A2895
04380         MVC   PR+050(8),DATE                                       A2895
04390         BAL   R9,WSYSLST                                           A2895
04400         XC    PR,PR                                                A2895
04410         BAL   R9,WSYSLST                                           A2895
04420         LR    R9,R0                                                A2895
04430         MVI   OV,C                                                 A2895
04440         BR    R9                                                   A2895
04450         SPACE 2                                                    A2895
04460EOJ      EQU   *                                                    A2895
04470         MVI   CC,X'8B'                                             A2895
04480         BAL   R9,WSYSLST                                           A2895
04490         MVI   CLSYSLST,15                                          A2895
04500        BAL   R9,WSYSLST                                            A2895
05010         WTM   SYSO12                                               A2895
05010         BSP   SYSO12                                               A2895
05020         EOJ                                                        A2895
05030LAST     DC    C'**'                                                A2895
05040DATE     DS    CL8                                                  A2895
05050TKID     DS    CL2                                                  A2895
05060DAY      DS    CL1                                                  A2895
05070OVW      DS    D                                                    A2895
05080CC       DC    CL90' '                                              A2895
05090RCNT     DC    PL4'0'                                               A2895
05100WCNT     DC    PL4'0'                                               A2895
05110ZCNT     DC    PL4'0'                                               A2895
05120EOD      CLI   CC,C'*'                                              A2895
05130         BE    EOJ                                                  A2895
05140         B     CANCEL                                               A2895
05150         LTORG                                                      A2895
05160RSYSIPT  RC    R9,SYSIPT,CD,EOD                                     A2895
```

7 - LOAD CALIBRATION DATA PROGRAM (cont'd)

```
05170UPSISW     DS   CL1                                                      A2895
05180CC         DS   CL1                                                      A2895
05190PR         DS   CL132                                                    A2895
05195CDH        DS   CL80                                                     A2895
05200WSYSLST    PRTM R9,SYSLST,CC,133,CV,CLSYSLST,BUFF,100,36                 A2895
05210RSYS011    RT   R9,SYS011,T1,R11,30,3600,ENDTF,,,0,0                     A2895
05220WSYS012    WT   R9,SYS012,T2,R10,30,3600,CL,SPBLK,,0,0                   A2895
05230BUFF       DS   CL1                                                      A2895
05240           CCW                                                           A2895
05250T1         DS   240CL30                                                  A2895
05260T2         DS   240CL30                                                  A2895
05270           END                                                           A2895
```

8 - TRANSLATE AND EDIT PROGRAM

```
// EXEC FORTRAN                                                 ROOT2096
      COMMON /CUT/ CUTOFF, LM, KVSF
      COMMON IC(100)                                            ROOT2096
      READ (1,80,END=95) IREC, KFILE,CUTOFF, LM, KVSF           ROOT2096
      IF (CUTOFF .EQ. 0.0) GO TO 200                            ROOT2096
      DO 100 IFILE = 1, KFILE                                   ROOT2096
      CALL OPSYS('LOAD','CALIN1  ')
      DO 10 I = 1, 100                                          ROOT2096
      IC(I) = 0                                                 ROOT2096
 10   CONTINUE                                                  ROOT2096
      CALL A2096(IFILE,IREC)                                    ROOT2096
 100  CONTINUE                                                  ROOT2096
 95   STOP                                                      ROOT2096
 80   FORMAT (2I5,F5.5,2I5)
 81   FORMAT ('1CUTOFF RATE IS EQUAL TO ZERO',////)             ROOT2096
 200  WRITE (3,81)                                              ROOT2096
 201  READ (1,80)      IREC                                     ROOT2096
      GO TO 201                                                 ROOT2096
      END                                                       ROOT2096
```

```
// EXEC ASSEMBLY                                                         A2096
         ICTL 6,71,21                                                    A2096
01010    PRINT NOGEN                                                     A2096
01020A2096      TITLE 'EPA CONVERT RAW DATA TAPES          120210ABC'    A2096
01030A2096      START                                                    A2096
01040           STM  14,12,12(13)                                        A2096
01050           ENTER R12,R7                                             A2096
01060           USING T1,R10                                             A2096
01070           USING T2,R11                                             A2096
01080           USING COMMON,R8                                          A2096
01090           ST   R13,SAV13                                           A2096
01100           L    R8,=A(COMMON)                                       A2096
01110           LA   R13,=9D'0'                                          A2096
01120*                                                                   A2096
01130*          MAIN LINE PASSES PARAMETER 1 = FILE NUMBER               A2096
01140*                           PARAMETER 2 = NUMBER RECORDS TO CHECK   A2096
01150*                                         FOR MACHINE MALFUNCTION   A2096
01160*                                         SHOULD APPROXIMATE 5 MIN  A2096
01170*                                                                   A2096
01180           LM   R2,R3,0(R1)                                         A2096
01190           L    R0,0(R2)                                            A2096
01200           CVD  R0,CVB                                              A2096
01210           ZAP  FILE,CVB                                            A2096
01220           L    R0,0(R3)                                            A2096
01230           CVD  R0,CVB                                              A2096
01240           ZAP  RECS,CVB                                            A2096
01250           BAL  R9,WSYS012                                          A2096
                L    R1,=V(CUT)
                L    R1,8(R1)
                CH   R1,=H'2'
                BNE  *+4+4+4
                MVI  VS10SW,0
                MVI  KILLCK,0
01260           COMRG                                                    A2096
01280           MVC  HDL4,0(R1)                                          A2096
01290           MVI  CC,X'8B'                                            A2096
01300           BAL  R9,WSYSLST                                          A2096
01310*                                                                   A2096
01320           BAL  R9,RSYSIN                                           A2096
01330           XC   PR,PR                                               A2096
01340           MVC  PR(30),T1                                           A2096
01350           BAL  R9,RSYSIN                                           A2096
01360           MVC  PR+30(30),T1                                        A2096
01370           BAL  R9,RSYSIN                                           A2096
01380           MVC  PR+60(30),T1                                        A2096
01390           MVC  T2,PR                                               A2096
01400           BAL  R9,WSYS012                                          A2096
01410           MVC  T2,PR+40                                            A2096
01420           BAL  R9,WSYS012                                          A2096
01430           MVC  TRKID,PR                                            A2096
01440           MVC  TRKDAY,PR+48                                        A2096
01450           MVC  HDL1,TRKID                                          A2096
01460           MVC  HDL2,TRKDAY                                         A2096
01470           MVC  HDL3,PR+47                                          A2096
01480           MVI  CC,9                                                A2096
01490           BAL  R9,WSYSLST                                          A2096
```

8 - TRANSLATE AND EDIT PROGRAM (cont'd)

```
01900*                                                         A2096
02010*       READ CONTROL CARD 3                               A2096
02020*                                                         A2096
02030        BAL  R9,RSYSIN                                    A2096
02040        MVC  CD(30),T1                                    A2096
02050        BAL  R9,RSYSIN                                    A2096
02060        MVC  CD+30(30),T1                                 A2096
02070        BAL  R9,RSYSIN                                    A2096
02080        MVC  CD+60(30),T1                                 A2096
02090        MVC  T2,CD                                        A2096
02100        BAL  R9,WSYSO12                                   A2096
02110        MVC  T2,CD+40                                     A2096
02120        BAL  R9,WSYSO12                                   A2096
02130        XC   PR,PR                                        A2096
02140        MVI  CC,9                                         A2096
02150        BAL  R9,WSYSLST                                   A2096
02160        MVC  PR(90),CD                                    A2096
02170        BAL  R9,WSYSLST                                   A2096
02240        OC   CD,=80C'0'                                   A2096
02250*                                                         A2096
02260*       STORE CONTSANTS IN COMMON FOR LATER USE           A2096
02270*                                                         A2096
02280        LA   R9,0        R9 = 1 THRU 6 (USED AS INDEX)    A2096
02290        LA   R2,6        LIMIT LOOP TO MAXIMUM OF 6 TIMES A2096
02300        LA   R3,CDRPM                                     A2096
02310*       R3 = CURRENT ENTRY IN CARD AREA                   A2096
02320*       FORM XXXXYYYY        XXXX = ACTUAL RPM            A2096
02330*                            YYYY = CALIBRATION READING   A2096
02340LP3     PACK CVB,0(4,R3)                                  A2096
02350        CP   CVB,=P'9999'  CHECK FOR LAST ENTRY IN CARD   A2096
02360        BE   RPMLDED                                      A2096
02370        CVB  R1,CVB                                       A2096
02380        ST   R1,PARM1                                     A2096
02390        PACK CVB,4(4,R3)                                  A2096
02400        CVB  R1,CVB                                       A2096
02410        ST   R1,PARM2                                     A2096
02420        AH   R9,=H'1'                                     A2096
02430        ST   R9,SIX                                       A2096
02440*                                                         A2096
02450*       LDRPM IS SUBROUTINE TO CONVERT TO FLOATING POINT  A2096
02460*            AND STORE IN COMMON FOR LATER USE            A2096
02470*                                                         A2096
02480        CALL LDRPM,(PARM1,PARM2,SIX,VAR)                  A2096
02490        LA   R3,9(R3)                                     A2096
02500        BCT  R2,LP3                                       A2096
03010RPMLDED EQU  *                                            A2096
03020        SPACE                                             A2096
03030*                                                         A2096
03040*       USES VALUES FROM CARD 3 TO DO LEAST SQUARE FIT    A2096
03050*                                                         A2096
03060        CALL LSFIT,(CPA,CPB,SIX,CPRPMA,VAR)               A2096
03070        SPACE 2                                           A2096
03080*                                                         A2096
03090*        CONVERT AMBIENT TEMPERATURE RECORD               A2096
03100*                                                         A2096
03110        BAL  R9,RSYSIN                                    A2096
03120        MVC  CD(30),T1                                    A2096
03130        BAL  R9,RSYSIN                                    A2096
03140        MVC  CD+30(30),T1                                 A2096
03150        BAL  R9,RSYSIN                                    A2096
03160        MVC  CD+60(30),T1                                 A2096
             MVC  CD+31(25),=40C' '
03170        MVC  T2,CD                                        A2096
03180        BAL  R9,WSYSO12                                   A2096
03190        MVC  T2,CD+40                                     A2096
03200        BAL  R9,WSYSO12                                   A2096
03210        CLI  CTMPA1,C'-'                                  A2096
03220        BNE  *+4+6                                        A2096
03230        MVZ  CTMPA2+L'CTMPA2-1(1),=C'J'                   A2096
03240        CLI  CTMPB1,C'-'                                  A2096
03250        BNE  *+4+6                                        A2096
03260        MVZ  CTMPB2+L'CTMPB2-1(1),=C'J'                   A2096
03270        MVC  CTMPA2-1,CTMPA2                              A2096
03280        MVC  CTMPB2-1,CTMPB2                              A2096
03290        FLOAT CTMPA1,7,3,CPTMPA                           A2096
03300        FLOAT CTMPB1,7,3,CPTMPB                           A2096
03310        SPACE 2                                           A2096
03320*                                                         A2096
03330*       READ AND STORE CARD 5 VARIABLES                   A2096
03340*                                                         A2096
03350        BAL  R9,RSYSIN                                    A2096
03360        MVC  CD(30),T1                                    A2096
03370        BAL  R9,RSYSIN                                    A2096
03380        MVC  CD+30(30),T1                                 A2096
03390        BAL  R9,RSYSIN                                    A2096
03400        MVC  CD+60(30),T1                                 A2096
03410        MVC  T2,CD                                        A2096
03420        BAL  R9,WSYSO12                                   A2096
03430        MVC  T2,CD+40                                     A2096
03440        BAL  R9,WSYSO12                                   A2096
03450        XC   PR,PR                                        A2096
03460        MVI  CC,9                                         A2096
03470        BAL  R9,WSYSLST                                   A2096
03480        MVC  PR(90),CD                                    A2096
03490        BAL  R9,WSYSLST                                   A2096
04060        PACK CVB,C5MPH                                    A2096
04070        CVB  R1,CVB                                       A2096
04080        ST   R1,PARM1                                     A2096
04090        PACK CVB,C5RD                                     A2096
04100        CVB  R1,CVB                                       A2096
04110        ST   R1,PARM2                                     A2096
04120        SPACE                                             A2096
04130        PACK CVB,CH10C1                                   A2096
04140        OI   CVB+7,15                                     A2096
04150        MP   CVB,=P'10000'         SHIFT DECIMAL          A2096
04160        CVB  R1,CVB                                       A2096
04170        PACK CVB,CH10C2                                   A2096
04180        OI   CVB+7,15                                     A2096
04190        CVB  R15,CVB                                      A2096
04200        AR   R1,R15                                       A2096
04210        ST   R1,PARM3                                     A2096
04220        SPACE
```

8 - TRANSLATE AND EDIT PROGRAM (cont'd)

```
04230         CALL CALCAS,(PARM1,PARM2,PARM3)                     A2096
04240         SPACE                                               A2096
04250         BAL  R9,OVRFL                                       A2096
04260         CALL DMPCOM                                         A2096
04270         BAL  R9,OVRFL                                       A2096
04280         SPACE 2                                             A2096
04290COPY     BAL  R9,RSYSIN          COPY UNUSED CALIBRATION DATA A2096
04300         MVC  CD(30),T1                                      A2096
04310         BAL  R9,RSYSIN                                      A2096
04320         MVC  CD+30(30),T1                                   A2096
04330         BAL  R9,RSYSIN                                      A2096
04340         MVC  CD+60(30),T1                                   A2096
              CLC  CD+78(2),=C'HP'
              BE   COPY
04350         MVC  T2,CD                                          A2096
04360         BAL  R9,WSYS012                                     A2096
04370         MVC  T2,CD+40                                       A2096
04380         BAL  R9,WSYS012                                     A2096
04390         CLI  CD,C'*'                                        A2096
04400         BNE  COPY                                           A2096
04410         SPACE 2                                             A2096
04420DATA     BAL  R9,RSYSIN                                      A2096
04460         AP   RECNT,=P'1'                                    A2096
05020         MVC  T2,=40C' '                                     A2096
05030         MVC  TRKID2,TRKID1                                  A2096
05040         OC   MR1(4),=80C'0'                                 A2096
05050         MVC  MR2,MR1                                        A2096
05060         MVC  MN2,MN1                                        A2096
05080         SPACE 2                                             A2096
05140*        CONVERT CHANNELS 8 AND 9 TO FLOATING POINT          A2096
05150*                                                            A2096
05160         PACK CVB,CH81                                       A2096
05170         CVB  R1,CVB                                         A2096
05180         ST   R1,PARM1                                       A2096
05190         PACK CVB,CH91                                       A2096
05200         OI   CVB+7,15                                       A2096
05210         CVB  R1,CVB                                         A2096
05220         ST   R1,PARM2                                       A2096
05230         CALL CFLOAT,(PARM1,PARM3)                           A2096
05240         MVC  CH82,PARM3                                     A2096
05262         CLC  TRKID1,=C'00'                                  A2096
05264         BNE  *+4+6                                          A2096
05268         AP   ERCNT,=P'1'                                    A2096
05269         SPACE 2                                             A2096
05270         MVC  CH92,PARM4                                     A2096
05280         XC   PR,PR                                          A2096
05290         MVC  PR+10(30),T1                                   A2096
05300*                                                            A2096
05310*        CONVERT CHANNELS 3,4,5,6, AND 7 TO BINARY           A2096
05320*                                                            A2096
05330         PACK CVB,RPM1           CHANNEL 3                   A2096
05340         CVB  R1,CVB                                         A2096
05350         ST   R1,PARM1                                       A2096
05360         PACK CVB,LF1            CHANNEL 4                   A2096
05370         CVB  R1,CVB                                         A2096
05380         ST   R1,PARM2                                       A2096
```

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05390         PACK CVB,VS1            CHANNEL 5                   A2096
05400         CVB  R1,CVB                                         A2096
05410         ST   R1,PARM3                                       A2096
05420         PACK CVB,RT1            CHANNEL 6                   A2096
05430         CVB  R1,CVB                                         A2096
05440         ST   R1,PARM4                                       A2096
05450         PACK CVB,TRAF1          CHANNEL 7                   A2096
05460         CVB  R1,CVB                                         A2096
05470         ST   R1,PARM5                                       A2096
05480         PACK CVB,VSFLAG                                     A2096
05490         OI   CVB+7,15                                       A2096
05500         LA   R1,1                                           A2096
06010         CP   CVB,=P'750'                                    A2096
     KILLCK   EQU  *+1
06020         BM   *+4+4                                          A2096
06030         LA   R1,0                                           A2096
06040         ST   R1,PARM8                                       A2096
     VSICSW   EQU  *+1
              B    DATA1
              CP   CVB,=P'5'
              BM   *+4+6
              XC   PARM3,PARM3        ZERO CH 5
06050*                                                            A2096
06060*                                                            A2096
06070*        CHECK RPM FOR NO CHANGE IN 5 MINUTES                A2096
06080*        IF SO, MALFUNCTION IN EQUIPMENT      (DATA IS USELESS) A2096
06090*                                                            A2096
06100DATA1    CLC  PARM1,LSTRPM                                   A2096
06110         BE   DUPRPM                                         A2096
06120         MVC  LSTRPM,PARM1                                   A2096
06130         ZAP  RPMCNT,=P'0'                                   A2096
06140DATA2    CLC  PARM2,LSTLF                                    A2096
06150*                                                            A2096
06160*        CHECK LOAD FACTOR FOR NO CHANGE IN 5 MINUTES        A2096
06170*        IF SO, MALFUNCTION IN EQUIPMENT      (DATA IS USELESS) A2096
06180*                                                            A2096
06190         BE   DUPLF                                          A2096
06200         MVC  LSTLF,PARM2                                    A2096
06210         ZAP  LFCNT,=P'0'                                    A2096
06220DATA3    CLC  PARM3,LSTVS                                    A2096
06230*                                                            A2096
06240*        CHECK VEHICLE SPEED FOR NO CHANGE IN 5 MINUTES      A2096
06250*        IF SO, MALFUNCTION IN EQUIPMENT      (DATA IS USELESS) A2096
06260*                                                            A2096
06270         BE   DUPVS                                          A2096
06280         MVC  LSTVS,PARM3                                    A2096
06290         ZAP  VSCNT,=P'0'                                    A2096
06300DATA4    EQU  *                                              A2096
06310         LA   R1,PLIST                                       A2096
06320*                                                            A2096
06330*        CHANNELS 3-7 READINGS PASSED THROUGH PARAMETERS 1-5 A2096
06340*        CONVERTED DATA RETURNED THROUGH PARAMETERS 6-10     A2096
06350*        PARAMETER 11 WILL CONTAIN THE HORSEPOWER RATIO      A2096
06360*                                                            A2096
06370         CALL CDATA                                          A2096
06380         MVC  RPM2,PARM6                                     A2096
```

8 - TRANSLATE AND EDIT PROGRAM (cont'd)

```
06390          MVC   LF2,PARM7                              A2096
06400          MVC   VS2,PARM8                              A2096
06410          MVC   RT2,PARM9                              A2096
06420          MVC   TRAF2,PARMA                            A2096
               MVC   RVRATIO,PARMC
06470WEFEC     EQU   *                                      A2096
06480          BAL   R9,WSYS012                             A2096
06490          TM    OV,15                                  A2096
06500          BZ    RDATA                                  A2096
07010          BAL   R9,OVRFL                               A2096
07020          B     RDATA                                  A2096
07030          SPACE 2                                      A2096
07110DUPRPM    AP    RPMCNT,=P'1'                           A2096
07120          CLC   PARM1,=C'0'                            A2096
07130          BE    DUPRPM1                                A2096
07140          CLC   PARM3,=C'C'                            A2096
07150          BE    DUPRPM1                                A2096
07160          CP    RPMCNT,RECS                            A2096
07170          BL    DATA2                                  A2096
07180          MVI   CC,19                                  A2096
07190          BAL   R9,WSYSLST                             A2096
07200          MVI   CC,9                                   A2096
07210          MVC   PR+42(30),=CL30'DUPLICATE RPM FOR 5 MINUTES'   A2096
07220          BAL   R9,WSYSLST                             A2096
07230DUPRPM1   EQU   *                                      A2096
07240          SP    RPMCNT,RPMCNT                          A2096
07250          B     DATA2                                  A2096
07260DUPLF     AP    LFCNT,=P'1'                            A2096
07270          CLC   PARM2,=C'0'                            A2096
07280          BE    DUPLF1                                 A2096
07290          CLC   PARM3,=C'0'                            A2096
07300          BE    DUPLF1                                 A2096
07310          CP    LFCNT,RECS                             A2096
07320          BL    DATA3                                  A2096
07330          MVI   CC,19                                  A2096
07340          BAL   R9,WSYSLST                             A2096
07350          MVI   CC,9                                   A2096
07360          MVC   PR+42(30),=CL30'DUPLICATE HP FOR 5 MINUTES'    A2096
07370          BAL   R9,WSYSLST                             A2096
07380DUPLF1    EQU   *                                      A2096
07390          ZAP   LFCNT,=P'0'                            A2096
07400          B     DATA3                                  A2096
07410DUPVS     AP    VSCNT,=P'1'                            A2096
07420          CLC   PARM3,=C'C'                            A2096
07430          BE    DUPVS1                                 A2096
07440          CP    VSCNT,RECS                             A2096
07450          BL    DATA4                                  A2096
07460          MVI   CC,19                                  A2096
07470          BAL   R9,WSYSLST                             A2096
07480          MVI   CC,9                                   A2096
07490          MVC   PR+42(30),=CL30'DUPLICATE VS FOR 5 MINUTES'    A2096
07500          BAL   R9,WSYSLST                             A2096
08010DUPVS1    EQU   *                                      A2096
08020          ZAP   VSCNT,=P'0'                            A2096
08030          B     DATA4                                  A2096
08040          SPACE 2                                      A2096
```

```
08050OVRFL     ST    R9,CVB                                 A2096
08060          XC    PR,PR                                  A2096
08070          MVI   CC,X'8B'                               A2096
08080          BAL   R9,WSYSLST                             A2096
08090          MVI   CC,27                                  A2096
08100          BAL   R9,WSYSLST                             A2096
08110          BAL   R9,WSYSLST                             A2096
08120          MVI   CC,25                                  A2096
08130          MVC   PR+10(L'HDL),HDL                       A2096
08140          BAL   R9,WSYSLST                             A2096
08150          MVI   OV,0                                   A2096
08160          L     R9,CVB                                 A2096
08170          BR    R9                                     A2096
08180          SPACE 2                                      A2096
08190WSYS012   WT    R9,SYS012,T2,R11,40,10000,CLSYS012,SHBLK,,0,0
08200RSYSIN    RT    R9,SYS011,T1,R10,30,3000,EOF,,,0,0     A2096
08210WSYSLST   PRT   R9,SYSLST,CC,133,CV,CLSYSLST           A2096
08220          SPACE 2                                      A2096
08500EOF       EQU   *                                      A2096
09010          MVI   CC,X'8B'                               A2096
09020          BAL   R9,WSYSLST                             A2096
09030          MVI   CC,9                                   A2096
09040          XC    PR,PR                                  A2096
09050          OI    FILE+L'FILE-1,15                       A2096
09060          UNPK  PR(10),FILE                            A2096
09070          MVC   PR+12(7),=C'FILE NO'                   A2096
09080          BAL   R9,WSYSLST                             A2096
09090          OI    RECNT+L'RECNT-1,15                     A2096
09100          UNPK  PR(10),RECNT                           A2096
09110          MVC   PR+12(12),=C'RECORDS READ'             A2096
09120          BAL   R9,WSYSLST                             A2096
09130          OI    ERCNT+L'ERCNT-1,15                     A2096
09140          UNPK  PR(10),ERCNT                           A2096
09150          MVC   PR+12(22),=C'ZERO RECORDS PROCESSED'   A2096
09160          BAL   R9,WSYSLST                             A2096
09170          MVI   CC,X'8B'                               A2096
09180          BAL   R9,WSYSLST                             A2096
09190          MVI   CLSYS012,15                            A2096
09200          BAL   R9,WSYS012                             A2096
09210          MVI   CLSYSLST,15                            A2096
09220          BAL   R9,WSYSLST                             A2096
09230          L     R13,SAV13                              A2096
09240          LM    R14,R12,12(R13)                        A2096
09250          BR    R14                                    A2096
09260          SPACE 2                                      A2096
09290HDL       DS    0CL40                                  A2096
09300          DC    C'TRUCK '                              A2096
09310HDL1      DC    CL2'  '                                A2096
09320          DC    C'  DAY '                              A2096
09330HDL2      DC    C'X'                                   A2096
09340          DC    C' OF '                                A2096
09350HDL3      DC    C'X'                                   A2096
09360          DC    20C' '                                 A2096
09370HDL4      DC    C'XX/XX/XX'                            A2096
09380          SPACE 1                                      A2096
09390RECS      DS    PL4                                    A2096
```

8 - TRANSLATE AND EDIT PROGRAM (cont'd)

```
C9400CFILE      DS    PL4                                      A2896
C9410RECNT      DC    PL4'0'                                   A2896
C9420ERCNT      DC    PL4'0'                                   A2896
C9430RPMCNT     DC    PL4'0'                                   A2896
C9440VSCNT      DC    PL4'0'                                   A2896
09450LFCNT      DC    PL4'0'                                   A2896
C9460LSTRPM     DC    F'0'                                     A2896
C9470LSTLF      DC    F'0'                                     A2896
C9480LSTVS      DC    F'0'                                     A2896
C9490           SPACE                                          A2896
09500PLIST      DC    A(PARM1,PARM2,PARM3,PARM4,PARM5)         A2896
10010           DC    A(PARM6,PARM7,PARM8,PARM9,PARMA)         A2896
                DC    A(PARMB)
10020           DC    X'80'                                    A2896
10030           DC    AL3(PARMC)                               A2896
10040PARM1      DS    F                                        A2896
10050PARM2      DS    F                                        A2896
10060PARM3      DS    F                                        A2896
10070PARM4      DS    F                                        A2896
10080PARM5      DS    F                                        A2896
10090PARM6      DS    F                                        A2896
10100PARM7      DS    F                                        A2896
10110PARM8      DS    F                                        A2896
10120PARM9      DS    F                                        A2896
10130PARMA      DS    F                                        A2896
10140PARMB      DS    F                                        A2896
10150PARMC      DS    F                                        A2896
10160           SPACE                                          A2896
10170CC         DS    0CL90                                    A2896
10180CD1        DS    0CL1                                     A2896
10190CD2        DS    0CL2                                     A2896
10200CD3        DS    0CL3                                     A2896
10210CD4        DS    0CL4                                     A2896
10220CDA        DS    0CL10                                    A2896
10230CTRKID     EQU   CD2                                      A2896
10240CT         EQU   CD1+79                                   A2896
10250CTRK       EQU   CD2                                      A2896
10260CDAY       EQU   CD1+2                                    A2896
10270CMP        EQU   CD1+3                                    A2896
10280CCRPM      EQU   CD+4                                     A2896
10290CH10C1     EQU   CD3+11                                   A2896
10300CH10C2     EQU   CD4+15                                   A2896
10310CSMPH      EQU   CD2+4                                    A2896
10320CSRC       EQU   CD3+7                                    A2896
10330CTMPA1     EQU   CD4+13                                   A2896
10340CTMPA2     EQU   CD3+18                                   A2896
10350CTMPB1     EQU   CD4+22                                   A2896
10360CTMPB2     EQU   CD3+27                                   A2896
10370           DS    CL90                                     A2896
10380SAV12      DS    F                                        A2896
10390           SPACE                                          A2896
10400CVB        DS    D                                        A2896
10410TRKID      DS    CL2                                      A2896
10420TRKDAY     DS    CL1                                      A2896
10430CC         DS    CL1                                      A2896
10440PR         DS    CL132                                    A2896
```

```
10450           LTORG                                          A2896
10460           DROP  R12                                      A2896
10470           DROP  R7                                       A2896
10480T1         DS    0CL30                                    A2896
10490T12        DS    0CL2                                     A2896
10500T13        DS    0CL3                                     A2896
11010CALIND     EQU   T13+27                                   A2896
11020CALPT      EQU   T12+2                                    A2896
11030CRPM       EQU   T13+6                                    A2896
11040CLF        EQU   T13+9                                    A2896
11050CVS        EQU   T13+12                                   A2896
11060TRKIC1     EQU   T12                                      A2896
11070HR1        EQU   T12+2                                    A2896
11080MN1        EQU   T12+4                                    A2896
11090CHE1       EQU   T13+21                                   A2896
11100CHS1       EQU   T13+24                                   A2896
11110RPM1       EQU   T13+6                                    A2896
11120LF1        EQU   T13+9                                    A2896
11130VS1        EQU   T13+12                                   A2896
11140RT1        EQU   T13+15                                   A2896
11150TRAF1      EQU   T13+18                                   A2896
11160VSFLAG     EQU   T13+27                                   A2896
11170           DS    240CL30                                  A2896
11180T2         DS    0CL40                                    A2896
11190T21        DS    0CL1                                     A2896
11200T22        DS    0CL2                                     A2896
11210T24        DS    0CL4                                     A2896
11220T23        DS    0CL3                                     A2896
11230TRKIC2     EQU   T22                                      A2896
11240HR2        EQU   T22+2                                    A2896
11250MN2        EQU   T22+4                                    A2896
11260DAY2       EQU   T21+6                                    A2896
11270CH02       EQU   T24+28                                   A2896
11280CH92       EQU   T24+32                                   A2896
11290RVRATIO    EQU   T24+36
11300RPM2       EQU   T24+8                                    A2896
11310LF2        EQU   T24+12                                   A2896
11320VS2        EQU   T24+16                                   A2896
11330RT2        EQU   T24+20                                   A2896
11340TRAF2      EQU   T24+24                                   A2896
11350           DS    540CL40
11360           CCM                                            A2896
11370COMMCN     EQU   *                                        A2896
11380SIX        DS    F'6'                                     A2896
11390YAR        DS    6E'0.0'                                  A2896
11400CMRPMA     DS    6F                                       A2896
11410CMA        DS    F                                        A2896
11420CMB        DS    F                                        A2896
11430CMAS       DS    F                                        A2896
11440CH10ACJ    DS    F                                        A2896
11450CMTMPA     DS    E                                        A2896
11460CMTMPB     DS    E                                        A2896
11470           END                                            A2896
```

8 - TRANSLATE AND EDIT PROGRAM (cont'd)

```
// EXEC FORTRAN                                                        CALB   2
// FTC LOAD=E                                                          CALB   3
      SUBROUTINE CALIB                                                 CALB   4
C
C                   DOES NOT CALCULATE HORSEPOWER
C
      COMMON /CUT/ CUTOFF, LM, KVSF                                    CALB
      COMMON ASIX, COMMON(6),                                          CALB   5
     1     RPM(6), A, B, AS, CHIOFX, TPPA, TPPB                        CALB   6
      DIMENSION X(4), Y(1), KYE(1), VAR(3)                             CALB   7
C
      INTEGER HIGH
      DATA LOW, HIGH /'LOW ', 'HIGH'/
C                                                                      CALB   8
C                    INITIALIZE VARIABLES                              CALB   9
C                                                                      CALB  10
      DATA CAL /1000.0/                                                CALB  11
  999 RETURN                                                           CALB  12
C                                                                      CALB  13
C                                                                      CALB  14
C                    STORES CONTROL CARD 3 VARIABLES IN ARRAYS         CALB  15
C                                                                      CALB  16
      ENTRY LCRPM (KLRPM,KLVAL,NDX,Y)                                  CALB  17
      RPM(NDX) = FLOAT(KLVAL) / DAL                                    CALB  18
      Y (NDX) = KLRPM                                                  CALB  19
      GO TO 999                                                        CALB  20
C                                                                      CALB  21
C                                                                      CALB  22
C                    CALCULATES CONVERSION FACTOR                      CALB  23
C                        WHICH CONVERTS DATA READINGS TO SPEED         CALB  24
C                                                                      CALB  25
      ENTRY CALCAS (MPH, KRD,KCHIOF)                                   CALB  26
      XX = MPH                                                         CALB  27
      XRD = FLOAT(KRD) / DAL                                           CALB  28
      AS =  XX  / XRD                                                  CALB  29
      CHIOF = FLOAT(KCHIOF) / 10000.0                                  CALB  30
      CHIOFX = CHIOF                                                   CALB  31
      IF (KCHIOF .EQ. 10000) CHIOFX = 0.0                              CALB  32
      GO TO 999                                                        CALB  33
C                                                                      CALB  34
C                                                                      CALB  35
C                    CONVERTS CHANNELS 8 AND 9 TO FLOATING POINT       CALB  36
C                                                                      CALB  37
      ENTRY CFLOAT(KYE,X)                                              CALB  38
C                    VALVE CLOSURE
C          OPEN = 0.0
C          CLOSED = 1.0
      X(1) = 0.0
      IF (LM .EQ. 0    .AND.
     1     KYE(1) .LT. 200)    X(1) = 1.0
      IF (LM .EQ. 1    .AND.
     1     KYE(1) .GE. 200)  X(1) = 1.0
C                    TEMPERATURE
      X(2) = TPPA * (FLOAT(KYE(2)) / CAL) + TPPB                       CALB  40
      GO TO 999                                                        CALB  41
C                                                                      CALB  42
```

```
C                                                                      CALB  43
C                    USING DATA STORED FROM ABOVE SUBROUTINES          CALB  44
C                        CONVERTS CHANNELS 3, 4, AND 5                 CALB  45
C                                                                      CALB  46
      ENTRY CDATA (KRPM,KFL,KSV,KRT,KTRF,                              CALB  47
     1     DRPM, DLF, DVS, DRT, DTRF, KFLAG, RVRAT)
      XX = FLOAT(KRPM) / DAL                                           CALB  49
      XRPM = A *  XX  + B                                              CALB  50
      XX = FLOAT(KSV) / DAL                                            CALB  51
      XVS = AS * XX                                                    CALB  52
      DRPM = XRPM                                                      CALB  53
      DVS = XVS                                                        CALB  54
      IF (KVSF .EQ. 1    .OR.
     1    KFLAG .GT.   0) DVS = DVS * CHIOF
C                                                                      CALB  56
      DLF = FLOAT(KFL) / DAL
C                                                                      CALC
C         FIX IDLE AND STOP CONDITIONS                                 CALB
C                                                                      CALB
      IF (DRPM .LT. 100.0) GO TO 101                                   CALB
      IF (DRPM .LT. CUTOFF) GO TO 102                                  CALB
      IF (DVS .LT. 0.5) GO TO 102                                      CALB
      GO TO 103                                                        CALB
  101 DRPM = 0.0                                                       CALB
  102 CONTINUE                                                         CALB
      DVS = 0.0                                                        CALB
  103 CONTINUE                                                         CALB
      RVRAT = 0.0
      IF (DVS .GT. 0.01)  RVRAT = DRPM / DVS
C                                                                      CALB  60
C         CONVERT CHANNELS 6 & 7                                       CALB  61
C                                                                      CALB  62
      DRT = 0.0                                                        CALB  63
      IF (KRT .GE. -950        .AND.                                   CALB  64
     1     KRT .LE.-850)                                               CALB  65
     1     DRT = 1.0                                                   CALB  66
      IF (KRT .GE.  -50        .AND.                                   CALB  67
     1     KRT .LE.50)                                                 CALB  68
     1     DRT = 2.0                                                   CALB  69
      IF (KRT .GE. 850         .AND.                                   CALB  70
     1     KRT .LE.950)                                                CALB  71
     1     DRT = 3.0                                                   CALB  72
      DTRF = 0.0                                                       CALB  73
      IF (KTRF.GE. -950        .AND.                                   CALB  74
     1     KTRF.LE.-850)                                               CALB  75
     1     DTRF= 1.0                                                   CALB  76
      IF (KTRF.GE.  -50        .AND.                                   CALB  77
     1     KTRF.LE.50)                                                 CALB  78
     1     DTRF= 2.0                                                   CALB  79
      IF (KTRF.GE. 850         .AND.                                   CALB  80
     1     KTRF.LE.950)                                                CALB  81
     1     DTRF= 3.0                                                   CALB  82
      GO TO 999                                                        CALB  83
C                                                                      CALB  84
C                                                                      CALB  85
C                    PRINT OUT VARIABLES IN COMMON                     CALB  86
```

-8 - TRANSLATE AND EDIT PROGRAM (cont'd)

```
                       INSERTED AS A BEGUGGING AIC ONLY                 CALB  87
C                                                                       CALB  88
C                                                                       CALB  89
      ENTRY CPFCCM                                                      CALB  90
      WRITE (3,82)                                                      CALB  91
      DO 603 J = 1, KSIX                                                CALB  92
  603 WRITE (3,90) J, C3RPM(J), RPM(J)                                  CALB  93
      WRITE (3,85) A, B                                                 CALB  94
      WRITE (3,89) A5
      LWSW = LOW
      IF (LH .EQ. 1) LWSW = HIGH
      WRITE (3,91) LWSW, CUTOFF
      IF (KVSF .EQ. 1)  WRITE (3,92)
      IF (KVSF .EQ. 2)  WRITE (3,93)                                    CALB  95
      GO TO 999                                                         CALB  96
   80 FORMAT ('1')                                                      CALB  97
   82 FORMAT ('0CARD 3 VARIABLES')                                      CALB  98
   84 FORMAT (' ', I5, 3F15.5)                                          CALB  99
   85 FORMAT ('0', 'A=',F20.3,5X, 'B=', F20.3)                          CALB 100
   89 FORMAT ('0', 'A5=',F20.3)                                         CALB 101
   90 FORMAT (' ',I3, 2F10.3)
   91 FORMAT ('0 VALVE CLOSED READING IS ',A4,   /,
     1     '0 RPM, IDLE CUTOFF IS ',F10.3)
   92 FORMAT ('0 VEHICLE BOOST VALUE IS BEING APPLIED TO ALL RECORDS')
   93 FORMAT ('0 CHANNEL 10 IS BEING USED TO CHECK ZERO VEHICLE SPEED')  CALB 102
      END
```

8 - TRANSLATE AND EDIT PROGRAM (cont'd)

```
// EXEC FFORTRAN
      SUBROUTINE DBG (A,B,C,D,E,F,G)
      WRITE (3,9C) A,B,C,D,E,F,G
      RETURN
 9C   FORMAT ('C',A4,5X,3(A4, ' = ', F15.5,5X))
      END
```

```
// EXEC FFORTRAN
      SUBROUTINE LSFIT (A,B,N,X,Y)                                      LSFIT
      DIMENSION X(1), Y(1)                                              LSFIT
      DATA PROG /'LSFI'/
C                                                                       LSFIT
C     N = NUMBER DATA POINTS                                            LSFIT
C     X = VOLTAGE                                                       LSFIT
C     Y = RPM                                                           LSFIT
C                                                                       LSFIT
      SMXY = C.C                                                        LSFIT
      SMX = C.C                                                         LSFIT
      SMY = C.C                                                         LSFIT
      SMX2 = C.C                                                        LSFIT
      DO 1CC K = 1, N                                                   LSFIT
      XX = X(K)                                                         LSFIT
      YY = Y(K)                                                         LSFIT
      SMXY = SMXY + XX * YY
      SMX = SMX + XX                                                    LSFIT
      SMY = SMY + YY                                                    LSFIT
      SMX2 = SMX2 + XX * XX                                             LSFIT
 100  CONTINUE                                                          LSFIT
      A1 = N * SMXY - SMX * SMY                                         LSFIT
      A2 = N * SMX2 - SMX * SMX
      A = C                                                             LSFIT
      IF (A2 .NE. C.O) A = A1 / A2                                      LSFIT
      B = (SMY - A * SMX) / N                                           LSFIT
      CALL DBG(PROG,'SMXY', SMXY,'SMX ',SMX,'SMY ',SMY)
      CALL DBG(PROG,'SMX2',SMX2,'XX  ',XX,'YY  ',YY)
      CALL DBG(PROG,'A1  ',A1, 'A2  ',A2,'A   ',A)
      CALL DBG(PROG,'B   ',B,'    ',0.0,'    ',0.0)
      RETURN                                                            LSFIT
      END
```

9 - MODE PROFILE PROGRAM

```
// EXEC COBOL
01010  IDENTIFICATION DIVISION.
01020  PROGRAM-ID.  'C2631'.                                             C2631
01030  ENVIRONMENT DIVISION.                                             C2631
01040  INPUT-OUTPUT SECTION.                                             C2631
01050  FILE-CONTROL.                                                     C2631
01060       SELECT PRTF ASSIGN 'SYS009' UNIT-RECORD 1403.                C2631
01070       SELECT TAPIN ASSIGN 'SYS011' UTILITY 2400.                   C2631
01080       SELECT TAPOT ASSIGN 'SYS012' UTILITY 2400.                   C2631
01090       SELECT SPOOL ASSIGN 'SYS013' UTILITY 2400.                   C2631
01100  DATA DIVISION.                                                    C2631
01110  FILE SECTION.                                                     C2631
01120                                                                    C2631
01130  FD  PRTF                                                          C2631
01140          RECORDING MODE F, LABEL RECORDS OMITTED,                  C2631
01150          DATA RECORD PRT.                                          C2631
01160  01  PRT.                                                          C2631
01170      07  CC   PICTURE X.                                           C2631
01180      07  PRT1 PICTURE X(81).                                       C2631
01190      07  PRT2 PICTURE X(50).                                       C2631
01200                                                                    C2631
01210  FD  TAPIN                                                         C2631
01220      RECORDING MODE F, LABEL RECORDS OMITTED,                      C2631
01230      BLOCK CONTAINS 90 RECORDS, RECORD CONTAINS 40 CHARACTERS,     C2631
01240      DATA RECORD TAPIN-REC.                                        C2631
01250  01  TAPIN-REC.                                                    C2631
01260      07  FILLER   PICTURE X(40).                                   C2631
01270                                                                    C2631
01280  FD  TAPOT                                                         C2631
01290          RECORDING MODE F, LABEL RECORDS OMITTED,                  C2631
01300          BLOCK CONTAINS 181 RECORDS RECORD CONTAINS 20 CHARACTERS  C2631
01310          DATA RECORD TAPOT-REC.                                    C2631
01320  01  TAPOT-REC.                                                    C2631
01330      07  O-FMODE  PICTURE 99V99.                                   C2631
01340      07  O-FMODEX REDEFINES O-FMODE.                               C2631
01350          14  O-MFM     PICTURE 99.                                 C2631
01360          14  O-SFM     PICTURE V99.                                C2631
01370      07  O-TMODE  PICTURE 99V99.                                   C2631
01380      07  O-TIME   PICTURE S9(7)V99, COMPUTATIONAL-3.               C2631
01390      07  O-FREQ   PICTURE S9(5)  COMPUTATIONAL-3.                  C2631
01400      07  FILLER   PICTURE XX.                                      C2631
01410      07  O-FLAGS        PICTURE X.                                 C2631
01420      07  O-FLAG         PICTURE X.                                 C2631
01430                                                                    C2631
01440                                                                    C2631
01450  FD  SPOOL    RECORDING MODE F,                                    C2631
01460               LABEL RECORDS OMITTED,                               C2631
01470               BLOCK CONTAINS 30 RECORDS,                           C2631
01480               RECORD CONTAINS 133 CHARACTERS,                      C2631
01490               DATA RECORD IS SPOOL-OUT.                            C2631
01500  01  SPOOL-OUT.                                                    C2631
02010      07  SPOOL-CC        PICTURE X.                                C2631
02020      07  SPOOL-IMAGE     PICTURE X(132).                           C2631
02030                                                                    C2631
02040                                                                    C2631
02050  WORKING-STORAGE SECTION.                                          C2631
                                                                         C2631
```

```
02060
02070  01  HEAD-1.                                                                  C2631
02080      07  FILLER          PICTURE X.                                           C2631
02090      07  FILLER   PICTURE X(22) VALUE 'EPA TRUCK STUDY 120210'.               C2631
02100      07  FILLER   PICTURE X(25) VALUE SPACE.                                  C2631
02110      07  HD1-DATE PICTURE X(19) VALUE SPACE.                                  C2631
02120      07  FILLER          PICTURE X(25) VALUE SPACE.                           C2631
02130      07  FILLER          PICTURE X(5) VALUE 'PAGE '.                          C2631
02140      07  HD1-PAGE        PICTURE 9(4) VALUE ZERO.                             C2631
02150                                                                               C2631
02160  01  HEAD-7.                                                                  C2631
02170      07  FILLER          PICTURE X.                                           C2631
02180      07  FILLER          PICTURE X(07) VALUE 'START  '.                       C2631
02190      07  FILLER          PICTURE X(8) VALUE 'FINISH  '.                       C2631
02200      07  FILLER          PICTURE XX  VALUE SPACE.                             C2631
02210      07  FILLER          PICTURE X(4) VALUE 'MODE'.                           C2631
02220      07  FILLER   PICTURE X(16) VALUE SPACE.                                  C2631
02230      07  FILLER   PICTURE X(9) VALUE 'SPEED    '.                             C2631
02240      07  FILLER   PICTURE X(7) VALUE 'SPEED  '.                               C2631
02250      07  FILLER   PICTURE X(8) VALUE 'SPEED   '.                              C2631
02260      07  FILLER   PICTURE X(9) VALUE 'CHANGE   '.                             C2631
02270      07  FILLER   PICTURE X(12) VALUE 'INTENSITY   '.                         C2631
02280      07  FILLER   PICTURE X(4) VALUE 'MODE'.                                  C2631
02290      07  FILLER   PICTURE X(6) VALUE SPACE.                                   C2631
02300      07  FILLER   PICTURE X(10) VALUE 'HORSEPOWER'.                           C2631
02310                                                                               C2631
02320  01  HEAD-20.                                                                 C2631
02330      07  FILLER   PICTURE X(38) VALUE SPACE.                                  C2631
02340      07  FILLER   PICTURE X(9) VALUE 'INITIAL  '.                             C2631
02350      07  FILLER   PICTURE X(7) VALUE 'FINAL  '.                               C2631
02360      07  FILLER   PICTURE X(8) VALUE 'CHANGE  '.                              C2631
02370      07  FILLER   PICTURE X(7) VALUE 'RATE OF'.                               C2631
02380      07  FILLER   PICTURE X(14) VALUE SPACE.                                  C2631
02390      07  FILLER   PICTURE X(7) VALUE 'TIME IN'.                               C2631
02400      07  FILLER   PICTURE X(3) VALUE SPACE.                                   C2631
02410      07  FILLER   PICTURE X(6) VALUE 'SUM OF'.                                C2631
02420                                                                               C2631
02430  01  DET-LINE.                                                                C2631
02440      07  FILLER          PICTURE X.                                           C2631
02450      07  DT-STIME        PICTURE 99.99.                                       C2631
02460      07  FILLER          PICTURE XXX VALUE SPACE.                             C2631
02470      07  DT-FTIME        PICTURE 99.99.                                       C2631
02480      07  FILLER          PICTURE XX VALUE SPACE.                              C2631
02490      07  DT-MODE         PICTURE 99.99.                                       C2631
02500      07  DT-MODEX  REDEFINES DT-MODE  PICTURE XX.                             C2631
03010      07  DT-MODE-DUMMY REDEFINES DT-MODE.                                     C2631
03020          14  DT-MODE9  PICTURE S99.                                           C2631
03030          14  FILLER    PICTURE X.                                             C2631
03040          14  DT-MODE99 PICTURE SV99.                                          C2631
03050      07  FILLER          PICTURE X, VALUE '-'.                                C2631
03060      07  DT-MODED        PICTURE X(14).                                       C2631
03070      07  FILLER   PICTURE XX  VALUE SPACE.                                    C2631
03080      07  DT-IN-SPD       PICTURE ---.9.                                       C2631
03090      07  FILLER          PICTURE X(4) VALUE SPACE.                            C2631
03100      07  DT-FN-SPD       PICTURE ---.9.                                       C2631
03110      07  FILLER          PICTURE XX, VALUE SPACE.                             C2631
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9 - MODE PROFILE (cont'd)

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03120         07  DT-CM-SPD      PICTURE ---.9.
03130         07  FILLER         PICTURE X(3) VALUE SPACE.                       C2631
03140         07  DT-RATE-CM     PICTURE ---.9.                                  C2631
03150         07  DT-XRATE-CM  REDEFINES DT-RATE-CM  PICTURE X(5).               C2631
03160         07  FILLER         PICTURE X(4) VALUE SPACE.                       C2631
03170         07  DT-INTENSITY   PICTURE ---.9.                                  C2631
03180         07  DT-XINTENSITY  REDEFINES DT-INTENSITY  PICTURE X(5).           C2631
03190         07  FILLER         PICTURE X(6) VALUE SPACE.                       C2631
03200         07  DT-TH          PICTURE 99.                                     C2631
03210         07  DT-PU          PICTURE X, VALUE '.'.                           C2631
03220         07  DT-TM          PICTURE 99.                                     C2631
03230         07  FILLER         PICTURE X, VALUE '.'.                           C2631
03240         07  DT-TS          PICTURE 99.                                     C2631
032500        07  FILLER   PICTURE X(1) VALUE SPACE.                             C2631
03260         07  DT-HP    PICTURE Z,ZZZ,ZZZ.99.                                 C2631
03270         07  DT-HPX   REDEFINES DT-HP  PICTURE X(12).                       C2631
03280         07  FILLER   PICTURE X(2) VALUE SPACE.                             C2631
032900        07  DT-ZERO        PICTURE X(4).                                   C2631
033000        07  FILLER   PICTURE X(3) VALUE SPACE.                             C2631
033100        07  DT-RECP  PICTURE 9(5) VALUE ZERO.                              C2631
033200        07  FILLER   PICTURE XX VALUE SPACE.                               C2631
033300        07  DT-ARECP PICTURE 9(5) VALUE ZERO.                              C2631
03340                                                                            C2631
03350   01  EIGHTY-BYTES.                                                        C2631
03360       07  EIGHTY-DUMMY.                                                    C2631
03370           14  BYTES-1-40       PICTURE X(40).                              C2631
03380           14  BYTES-41-80      PICTURE X(40).                              C2631
03390       07  TRK-IDENT-FMT REDEFINES EIGHTY-DUMMY.                            C2631
03400           14  M-TRK-ID         PICTURE XX.                                 C2631
03410           14  M-CITY           PICTURE X.                                  C2631
03420           14  M-TYP-TRK        PICTURE X.                                  C2631
03430           14  M-FUEL           PICTURE X.                                  C2631
03440           14  M-WEIGHT         PICTURE XX.                                 C2631
03450           14  M-LICENSE        PICTURE X(8).                               C2631
03460           14  M-IND            PICTURE XX.                                 C2631
03470           14  M-ENGINE         PICTURE X(10).                              C2631
03480           14  M-SERIAL         PICTURE X(20).                              C2631
03490           14  M-NDAYS          PICTURE X.                                  C2631
03500           14  M-DAY            PICTURE X.                                  C2631
04010       07  TRK-DT-IDENT REDEFINES EIGHTY-DUMMY.                             C2631
04020           14  TRK-DT-1  PICTURE X(19) OCCURS 4 TIMES.                      C2631
04030       07  TRK-TEMPERATURE REDEFINES EIGHTY-DUMMY.                          C2631
04040           14  FILLER     PICTURE X(4).                                     C2631
04050           14  TRK-AMBIENT     PICTURE S9(4).                               C2631
04060           14  FILLER     PICTURE X(41).                                    C2631
                14  TRK-VC1    PICTURE X.
                14  FILLER     PICTURE X.
                14  TRK-VC2    PICTURE 999.
                14  FILLER     PICTURE X(24).
04070           14  TRK-CD-TYP      PICTURE X(2).
04080       07  TRK-GEAR-RATIO REDEFINES EIGHTY-DUMMY.                           C2631
04090           14  FILLER     PICTURE X(4).                                     C2631
04100           14  TRK-GEAR   PICTURE S9.                                       C2631
04110           14  FILLER     PICTURE X.                                        C2631
04120           14  TRK-RV1    PICTURE S9(4).                                    C2631
04130           14  FILLER     PICTURE X.                                        C2631
                                                                                 C2631
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04140         14  TRK-RV2   PICTURE SV999.
04150                                                                   C2631
04160   01  MD3.                                                        C2631
04170       07  FILLER          PICTURE X(7)  VALUE ' TRUCK='.          C2631
04180       07  MD3-TRK-ID      PICTURE XX.                             C2631
04190       07  FILLER          PICTURE X(6)  VALUE '  DAY='.           C2631
04200       07  MD3-DAY         PICTURE X.                              C2631
04210       07  FILLER          PICTURE X(7)  VALUE '  CITY='.          C2631
04220       07  MD3-CITY        PICTURE X(4).                           C2631
04230       07  FILLER          PICTURE X(13) VALUE '  TYPE TRUCK='.    C2631
04240       07  MD3-TYP         PICTURE X.                              C2631
04250       07  FILLER          PICTURE X(12) VALUE '  FUEL TYPE='.     C2631
04260       07  MD3-FUEL        PICTURE X(6).                           C2631
04270       07  FILLER          PICTURE X(9)  VALUE '  WEIGHT='.        C2631
04280       07  MD3-WT          PICTURE XX.                             C2631
04290       07  FILLER          PICTURE X(10) VALUE '  LICENSE='.       C2631
04300       07  MD3-LICENSE     PICTURE X(8).                           C2631
04310       07  FILLER          PICTURE X(11) VALUE '  INDUSTRY='.      C2631
04320       07  MD3-IND         PICTURE XX.                             C2631
04330                                                                   C2631
04340   01  MD4.                                                        C2631
04350       07  FILLER          PICTURE X(14) VALUE ' ENGINE MODEL='.   C2631
04360       07  MD4-ENGINE      PICTURE X(10).                          C2631
04370       07  FILLER          PICTURE X(16) VALUE '  SERIAL NUMBER='. C2631
04380       07  MD4-SERIAL      PICTURE X(20).                          C2631
04390       07  FILLER          PICTURE X(15) VALUE '  DAYS SAMPLED='.  C2631
04400       07  MD4-NDAYS       PICTURE X.                              C2631
04410                                                                   C2631
04420   01  CON-STANT-S.                                                C2631
04430                                                                   C2631
04440       07  MODE-TOTALS  COMPUTATIONAL-3  OCCURS 10 TIMES.          C2631
04450           14  MODE-TOTALS2  OCCURS 10 TIMES.                      C2631
04460               21  MT-MFREQ  PICTURE S9(5).                        C2631
04470               21  MT-MTIME  PICTURE S9(5)V99.                     C2631
04480           14  RD-TIM  OCCURS 4 TIMES  PICTURE S9(7).              C2631
04490       07  MODE-TOTALS1 COMPUTATIONAL-3  OCCURS 110  TIMES.        C2631
04500           14  MT-SFREQ  PICTURE S9(5).                            C2631
05010           14  MT-STIME  PICTURE S9(5)V99.                         C2631
05020           14  MT-FMODE  PICTURE S99V99.                           C2631
05030           14  MT-TMODE  PICTURE S99V99.                           C2631
05040                                                                   C2631
05050       07  COMP-X-X    COMPUTATIONAL.                              C2631
05060           14  X1   PICTURE S9(4).                                 C2631
05070           14  X2   PICTURE S9(4).                                 C2631
05080           14  X3        PICTURE S999 VALUE 1.                     C2631
05090           14  X4        PICTURE S999 VALUE 31.                    C2631
05100           14  X5        PICTURE S999 VALUE 10.                    C2631
05110           14  X6        PICTURE S999 VALUE 5.                     C2631
05120           14  X7        PICTURE S999 VALUE 100.                   C2631
05130           14  X8        PICTURE S999 VALUE 36.                    C2631
05140           14  X9        PICTURE S999 VALUE 11.                    C2631
05150                                                                   C2631
05160           14  KILL-TR   PICTURE S999 VALUE 13.                    C2631
05170                                                                   C2631
05180       07  INIT-CHECK     PICTURE X.                               C2631
05190       07  FIRST-PRINT    PICTURE X, VALUE ZERO.                   C2631
                                                                        C2631
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9 - MODE PROFILE (cont'd)

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05200        07  FLF-SWITCH     PICTURE X, VALUE ZERO.                     C2631
05210        07  FCH-SWITCH     PICTURE X, VALUE ZERO.                     C2631
05220        07  FIRST-SWITCH   PICTURE X VALUE ZERO.                      C2631
             07  VC-SWITCH      PICTURE X, VALUE 'N'.
05230                                                                      C2631
05240        07  W-DESC         PICTURE X(14).                             C2631
05250                                                                      C2631
05260                                                                      C2631
05270        07  HOLD-MODE      PICTURE XX VALUE ZERO.                     C2631
05280        07  SUB-MODE       PICTURE S9.                                C2631
05290        07  SUB-MODE-1     PICTURE V99 REDEFINES SUB-MODE.            C2631
05300        07  NEW-MODE       PICTURE S9V99, COMPUTATIONAL-3.            C2631
05310        07  MODX           PICTURE S9V99 COMPUTATIONAL-3.             C2631
05220        07  LAST-MODX      PICTURE S9V99  COMPUTATIONAL-3             C2631
05330                           VALUE 01.00.                               C2631
05340        07  W-TIME   PICTURE S9(7)V99  COMPUTATIONAL-3.               C2631
05350                                                                      C2631
05360        07  RECNO    PICTURE 9(5) VALUE ZERO.                         C2631
05370        07  LINCNT         PICTURE S999 COMPUTATIONAL-3 VALUE 998.    C2631
05380        07  COMP--3--3   COMPUTATIONAL-3.                             C2631
05390            14  LOOK-AHEAD      PICTURE S999, VALUE ZERO.             C2631
05400            14  FORCE-ACC       PICTURE S999, VALUE ZERO.             C2631
05410            14  FORCE-DEC       PICTURE S999, VALUE ZERO.             C2631
05420            14  SUM-VC          PICTURE S9(5) VALUE ZERO.             C2631
05430        07  REC-LEFT PICTURE S999 COMPUTATIONAL-3 VALUE ZERO.         C2631
05440        07  TW1      PICTURE S9(7) COMPUTATIONAL-3.                   C2631
05450        07  TW2      PICTURE S9(7) COMPUTATIONAL-3.                   C2631
05460        07  TW3      PICTURE S9(7) COMPUTATIONAL-3.                   C2631
05470        07  TW4      PICTURE S99V9 COMPUTATIONAL-3.                   C2631
05480        07  TW5      PICTURE S99V9 COMPUTATIONAL-3.                   C2631
05490        07  INTENS   PICTURE 99V9 COMPUTATIONAL-3.                    C2631
05500        07  DT-AREC  PICTURE S9(5) VALUE ZERO COMPUTATIONAL-3.        C2631
06010                                                                      C2631
06020        07  TAPCT-HOLD     PICTURE X(20).                             C2631
06030                                                                      C2631
06040        07  T-TRUCK-IDX    PICTURE XX.                                C2631
06050        07  T-DAYX         PICTURE X.                                 C2631
06060                                                                      C2631
06070        07  TRAFFIC-CONDITION  COMPUTATIONAL-3.                       C2631
06080            14  TRAF-4     PICTURE S9(7)V99  OCCURS 3 TIMES.          C2631
06090                                                                      C2631
06100        07  C-CTL    PICTURE X.                                       C2631
06110                                                                      C2631
06120    01  GEN-ST-COMP-1      COMPUTATIONAL-1.                           C2631
06130        07  W-VS-RPM.                                                 C2631
06140        07  LAST-VS-RPM.                                              C2631
06150        07  LAST-VS.                                                  C2631
06160        07  INIT-VS.                                                  C2631
06170        07  AVG-SPEED-CHANGE.                                         C2631
06180                                                                      C2631
06190        07  GEAR-RATIO-HEADER.                                        C2631
06200            14  GEAR1.                                                C2631
06210            14  GEAR2.                                                C2631
06220            14  GEAR3.                                                C2631
06230            14  GEAR4.                                                C2631
06240            14  GEAR5.                                                C2631
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06250        07  GEAR-RATIO-X REDEFINES GEAR-RATIO-HEADER.                 C2631
06260            14  GEAR-RATIO OCCURS 5 TIMES.                            C2631
06270                                                                      C2631
06280        07  AMBIENT-PLUS-FIFTY.                                       C2631
06290                                                                      C2631
06300    01  C-TABLE-1.                                                    C2631
06310        03  SM-SPD   COMPUTATIONAL-2  OCCURS 4 TIMES.                 C2631
06320        03  SM-RT1  OCCURS 5 TIMES  COMPUTATIONAL-3.                  C2631
06330            07  SM-RT  OCCURS 3 TIMES  PICTURE S9(7).                 C2631
06340        03  C-TAB-2        PICTURE X(300).                            C2631
06350        03  C-TAB-3  REDEFINES C-TAB-2.                               C2631
06360            07  C-TABLE  OCCURS 4 TIMES.                              C2631
06370                14  ST-TIME    PICTURE S99V99.                        C2631
06380                14  FN-TIME    PICTURE S99V99.                        C2631
06390                14  T-MODE     PICTURE S99V99.                        C2631
06400                14  MODED      PICTURE X(14).                         C2631
06410                14  INIT-SPD       PICTURE S999V9.                    C2631
06420                14  FIN-SPD        PICTURE S999V9.                    C2631
06430                14  MIN-SPD        PICTURE S999V9.                    C2631
06440                14  MAX-SPD        PICTURE S999V9.                    C2631
06450                14  REC        PICTURE S9(5).                         C2631
06460                14  Z-REC      PICTURE X.                             C2631
06470                14  ENT-ACT    PICTURE X.                             C2631
06480                14  OBC-VC      PICTURE S9(5) COMPUTATIONAL-3.        C2631
06490                14  HP-SUM      COMPUTATIONAL-1.                      C2631
06500        03  C-TAB-4  REDEFINES C-TAB-2.                               C2631
07010            07  C-TAB-5  OCCURS 4 TIMES.                              C2631
07020                21  FILLER  PICTURE X(8).                             C2631
07030                21  MODER PICTURE 99.                                 C2631
07040                21  MODES PICTURE V99.                                C2631
07050                21  FILLER  PICTURE X(44).                            C2631
07060                                                                      C2631
07070    01  COMP-LT-2    COMPUTATIONAL-2.                                 C2631
07080        07  RD-SPX   OCCURS 10 TIMES.                                 C2631
07090            14  RD-SPD    OCCURS 4 TIMES.                             C2631
07100        07  DST-TRV.                                                  C2631
07110        07  DST-DIV.                                                  C2631
07120                                                                      C2631
07130                                                                      C2631
07140    01  W-TAPIN-REC.                                                  C2631
07150        07  T-TRUCK-ID     PICTURE XX.                                C2631
07160        07  T-TIME         PICTURE S9V99.                             C2631
07170        07  T-DAY          PICTURE X.                                 C2631
07180        07  FILLER         PICTURE X.                                 C2631
07190        07  T-RPM          COMPUTATIONAL-1.                           C2631
07200        07  T-LF           COMPUTATIONAL-1.                           C2631
07210        07  T-VS           COMPUTATIONAL-1.                           C2631
07220        07  T-RT     COMPUTATIONAL-1.                                 C2631
07230        07  T-TC     COMPUTATIONAL-1.                                 C2631
07240        07  T-WC     COMPUTATIONAL-1.
07260        07  T-TMP    COMPUTATIONAL-1.                                 C2631
07270        07  HP-RATIO COMPUTATIONAL-1.                                 C2631
07280                                                                      C2631
07290                                                                      C2631
07300    01  TAPIN-REC-SAVED-RECORDS.                                      C2631
07310        02  S-TAPIN-REC  OCCURS 10 TIMES.                             C2631
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9 - MODE PROFILE (cont'd)

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C732C      C7  S-TRUCK-ID    PICTURE XX.
C7330      C7  S-TIME        PICTURE S9V99.                   C2631
C7340      C7  S-DAY         PICTURE X.                       C2631
C735C      C7  FILLER        PICTURE X.                       C2631
C736C      C7  S-PPP         CCMPLTATICNAL-1.                 C2631
C737C      C7  S-LF          COMPLTATICNAL-1.                 C2631
C7380      C7  S-VS          COMPLTATICNAL-1.                 C2631
C7390      C7  S-RT     COMPUTATICNAL-1.                      C2631
C74C0      07  S-TC     COMPUTATICNAL-1.                      C2631
C7410      07  S-VC     COMPUTATICNAL-1.                      C2631
C7430      C7  S-TMP    COMPUTATICNAL-1.
C7440      C7  SP-RATIO COMPUTATICNAL-1.                      C2631
C7450                                                         C2631
C746C                                                         C2631
C747C                                                         C2631
C7480  C1  CPTICN.                                            C2631
C7490      C7  OPT1      PICTURE X.                           C2631
C7500      C7  CPT2      PICTURE 99999.                       C2631
C8010  PRCCEDLRE CIVISICN.                                    C2631
C8C20      ACCEPT CPTICN.                                     C2631
C8030      IF CPT2 NCT NUMERIC MOVE 999 TC CPT2.              C2631
C8040      OPEN INPLT          TAPIN WITH NC REWIND           C2631
C8C50          OUTPLT TAPOT, PRTF, SPCCL WITH NC REWINC.      C2631
C8060      ENTER LINKAGE.                                     C2631
C8070          CALL 'MOTPAK' USING KILL-TP.                   C2631
C8080      ENTER COBOL.                                       C2631
C8090      ENTER LINKAGE.  CALL 'GETDAT' USING MD1-DATE.      C2631
C81C0      ENTER CCBCL.                                       C2631
C8110      ENTER LINKAGE.  CALL 'SUPRS'.  ENTER CCBCL.        C2631
C8120      MCVE LCW-VALLE TO                                  C2631
C8130          GEAR-RATIO-HEADER.                             C2631
C8140      MCVE ZERG TO AMBIENT-PLUS-FIFTY.                   C2631
C8150                                                         C2631
C8160      PERFORM MOVE-HEADER.                               C2631
           IF CPT1      = 9 GC TC SKIP-THIS-CEBUG.
           MCVE SPACE TO PRT.
           WRITE PRT AFTER 0.
           EXHIBIT NAMED GEAR1.
           EXHIBIT NAMED GEAR2.
           EXHIBIT NAMED GEAR3.
           EXHIBIT NAMED GEAR4.
           EXHIBIT NAMED GEAR5.
           EXHIBIT NAMEC AMBIENT-PLUS-FIFTY.
           EXHIBIT NAMEC VC-SWITCH.
       SKIP-THIS-CEBUG.
C8230      MCVE 1 TO X1.
C8240      PERFORM CLEARM 10 TIMES.                           C2631
C8250      MCVE 1 TC X1.                                      C2631
C8260      PERFORM CLEARS  X7  TIMES.                         C2631
C8270      MCVE ZERO TO C-TABLE-1.                            C2631
08280      MCVE ZERC TO TRAF-4 (1), TRAF-4 (2), TRAF-4 (3).   C2631
C8290      MOVE ZERC TO SM-SPD (1), SP-SPD (2), SP-SPC (3), SM-SPD (4),   C2631
C8?0C          SM-RT (4, 1), SM-RT (4, 2), SP-RT (4, 3).      C2631
08?10      MCVE SM-RT1 (4) TO SM-RT1 (1), SM-RT1 (2), SP-RT1 (3),   C2631
               SM-RT1 (5).                                    C2631
C8320      CCMPLTE CST-DIV = 0.88 / 360C.0.                   C2631
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C833C
C834C                                                                  C2631
C835C      READ TAPIN AT END STCP RUN.                                 C2631
08360      MCVE TAPIN-REC TC S-TAPIN-REC (2).  ADC 1 TG REC-LEFT.      C2631
C837C      READ TAPIN AT END STOP RUN.                                 C2631
C838C      MCVE TAPIN-REC TC S-TAPIN-REC (3).  ADC 1 TC REC-LEFT.      C2631
C8390  SKIP-I-E.                                                       C2631
C8400      NCTE   **  **  **   * * * *                                 C2631
C8410      READ TAPIN AT END STOP RUN.                                 C2631
C8420      MCVE TAPIN-REC TO S-TAPIN-REC (4).  ADC 1 TC REC-LEFT.      C2631
C843C      READ TAPIN AT END STOP RUN.                                 C2631
C8440      MOVE TAPIN-REC TO S-TAPIN-REC (5).  ACC 1 TO REC-LEFT.      C2631
C845C      READ TAPIN AT END STOP RUN.                                 C2631
C8460      MCVE TAPIN-REC TG S-TAPIN-REC (6).  ADC 1 TO REC-LEFT.      C2631
C8470      READ TAPIN AT END STOP RUN.                                 C2631
C8480      MCVE TAPIN-REC TC S-TAPIN-REC (7).  ACC 1 TC REC-LEFT.      C2631
C8490                                                                  C2631
08500                                                                  C2631
C9010  RD-LOCP.                                                        C2631
C9C20      PERFORM GET-RECCRD.                                         C2631
C9030      IF EOF-SWITCH = 1                                           C2631
C9040          GO TG END-FILE.                                         C2631
C9C50      IF CT-AREC GREATER THAN CPT2 MCVE 1 TC ECR-SWITCH.          C2631
C9060          CCMPUTE DST-TRV = T-VS * CST-DIV.                       C2631
C9070      IF T-TC = 1.C ADD 1.00 TO TRAF-4 (1).                       C2631
C9C80      IF T-TC = 2.0 ADD 1.0C TC TRAF-4 (2).                       C2631
C9C90      IF T-TC = 3.C ADD 1.00 TC TRAF-4 (3).                       C2631
C9100                                                                  C2631
C9110                                                                  C2631
C9120                                                                  C2631
C9130                                                                  C2631
C9140      IF T-TRUCK-ID = 'OC'
C9150          MOVE 'Z' TO Z-REC (1).                                  C2631
C9160      PERFCRM FIND-MODE.                                          C2631
C9170      IF FIRST-SWITCH = ZERO                                      C2631
C9180          GC TC REBLD.                                            C2631
C9190      IF MODX NOT = T-MCDE (1)                                    C2631
C9200          GO TO BREAK-1.                                          C2631
C9210  PRCCESS.                                                        C2631
C9220      ACC DST-TRV TO SM-SPD (1).                                  C2631
C9230      IF T-RT = 1 ADD 1 TC SP-RT (1, 1).                          C2631
C9240      IF T-RT = 2 ADD 1 TC SP-RT (1, 2).                          C2631
C9250      IF T-RT = 3 ADD 1 TC SP-RT (1, 3).                          C2631
C9260  PRCCESS-1.                                                      C2631
C927C      MCVE T-TIME TC FN-TIME (1).                                 C2631
C928C      MOVE T-VS TO FIN-SPD (1).                                   C2631
C9290      IF T-LF GREATER THAN 0.C                                    C2631
C9300          ADC T-LF TO HP-SUM (1).                                 C2631
C9310      IF T-VC LESS THAN .200                                      C2631
C9320          ADC 1 TO DEC-VC (1).                                    C2631
C9330      ACC 1 TO REC (1).                                           C2631
C9340      MCVE 1 TO ENT-ACT (1).                                      C2631
09350      IF FIN-SPD (1) LESS THAN MIN-SPC (1)                        C2631
C9360          MOVE FIN-SPD (1) TC MIN-SPC (1).                        C2631
C9370      IF FIN-SPD (1) GREATER THAN MAX-SPC (1)                     C2631
C938C          MOVE FIN-SPD (1) TC MAX-SPC (1).                        C2631
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9 - MODE PROFILE (cont'd)

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09390      GO TO RD-LOOP.                                          C2631
09400                                                              C2631
09410  BREAK-1.                                                    C2631
09420      IF FIRST-PRINT = ZERO                                   C2631
09430          MOVE SPACE TO FIRST-PRINT.                          C2631
09440          GO TO BREAK-2.                                      C2631
09450      IF REC (1) = 1                                          C2631
09460          GO TO DUMMY-IN.                                     C2631
09470      IF ENT-ACT (3) = 1 PERFORM PRINT-LINE.                  C2631
09480  BREAK-2.                                                    C2631
           MOVE C-TABLE (3) TO C-TABLE (4).
09490      MOVE C-TABLE (2) TO C-TABLE (3).                        C2631
09500      MOVE C-TABLE (1) TO C-TABLE (2).                        C2631
           MOVE SM-SPD (3) TO SM-SPD (4).
10010      MOVE SM-SPD (2) TO SM-SPD (3).                          C2631
10020      MOVE SM-SPD (1) TO SM-SPD (2).                          C2631
           MOVE SM-RT1 (3) TO SM-RT1 (4).
10030      MOVE SM-RT1 (2) TO SM-RT1 (3).                          C2631
10040      MOVE SM-RT1 (1) TO SM-RT1 (2).                          C2631
10050  REBLD.                                                      C2631
10060      MOVE SPACE TO FIRST-SWITCH, C-TABLE (1).                C2631
10070      MOVE T-TIME TO ST-TIME (1).                             C2631
10080      MOVE T-TIME TO FN-TIME (1).                             C2631
10090      MOVE MODA TO T-MODE (1).                                C2631
10100     .MOVE M-DESC TO MODED (1).                               C2631
10110      MOVE T-VS TO INIT-SPD (1), FIN-SPD (1), INIT-VS,        C2631
10120          MIN-SPD (1), MAX-SPD (1).                           C2631
10130      MOVE 1 TO REC (1).                                      C2631
10140      MOVE 1 TO ENT-ACT (1).                                  C2631
10150      MOVE SM-RT1 (5) TO SM-RT1 (1).                          C2631
10160      MOVE DST-TRV TO SM-SPD (1).                             C2631
10170      IF T-VC LESS THAN .200                                  C2631
10180          MOVE 1 TO DEC-VC (1).          ELSE                 C2631
10190              MOVE ZERO TO DEC-VC (1).                        C2631
10200      IF T-LF GREATER THAN 0.0                                C2631
10210          MOVE T-LF TO HP-SUM (1).    ELSE                    C2631
10220              MOVE 0.0 TO HP-SUM (1).                         C2631
10230      GO TO RD-LOOP.                                          C2631
10240                                                              C2631
10250  DUMMY-IN.                                                   C2631
10260      MOVE FN-TIME (1) TO FN-TIME (2).                        C2631
10270      MOVE FIN-SPD (1) TO FIN-SPD (2).                        C2631
10280      ADD 1 TO REC (2).                                       C2631
10290      IF MIN-SPD (1) LESS THAN MIN-SPD (2)                    C2631
10300          MOVE MIN-SPD (1) TO MIN-SPD (2).                    C2631
10310      IF MAX-SPD (1) GREATER THAN MAX-SPD (2)                 C2631
10320          MOVE MAX-SPD (1) TO MAX-SPD (2).                    C2631
10330      ADD SM-SPD (1) TO SM-SPD (2).                           C2631
10340      ADD SM-RT (1, 1) TO SM-RT (2, 1).                       C2631
10350      ADD SM-RT (1, 2) TO SM-RT (2, 2).                       C2631
10360      ADD SM-RT (1, 3) TO SM-RT (2, 3).                       C2631
10370      ADD DEC-VC (1) TO DEC-VC (2).                           C2631
10380      ADD HP-SUM (1) TO HP-SUM (2).                           C2631
10390      GO TO REBLD.                                            C2631
10400                                                              C2631
10410  CLEARM.                                                     C2631
10420      MOVE ZERO TO RD-SPD (X1, 1), RD-SPD (X1, 2), RD-SPD (X1, 3),   C2631
10430          RD-TIM (X1, 4), RD-SPD (X1, 4),                     C2631
10440          RD-TIM (X1, 1), RD-TIM (X1, 2), RD-TIM (X1, 3).     C2631
10450      MOVE 1 TO X2.                                           C2631
10460      PERFORM CLEARM1 10 TIMES.                               C2631
10470      ADD 1 TO X1.                                            C2631
10480  CLEARM1.                                                    C2631
10490      MOVE ZERO TO MT-MFREQ (X1, X2), MT-MTIME (X1, X2).      C2631
10500      ADD 1 TO X2.                                            C2631
11010      NOTE * * *  END OF PERFORMED ROUTINE * * *.             C2631
11020  CLEARS.                                                     C2631
11030      MOVE ZERO TO MT-SFREQ (X1), MT-STIME (X1),              C2631
11040          MT-FMODE (X1), MT-TMODE (X1).                       C2631
11050      ADD 1 TO X1.                                            C2631
11060      NOTE * * *  END OF PERFORMED ROUTINE * * *.             C2631
11070                                                              C2631
11080  OVRFL.                                                      C2631
11090      ADD 1 TO HD1-PAGE.                                      C2631
11100      MOVE HEAD-1 TO PRT.                                     C2631
11110      MOVE 1 TO C-CTL.                                        C2631
11120      PERFORM WRITE-SPOOL.                                    C2631
11130      MOVE HD3 TO PRT.                                        C2631
11140      MOVE ZERO TO C-CTL.                                     C2631
11150      PERFORM WRITE-SPOOL.                                    C2631
11160      MOVE HD4 TO PRT.                                        C2631
11170      MOVE ' ' TO C-CTL.                                      C2631
11180      PERFORM WRITE-SPOOL.                                    C2631
11190      MOVE HEAD-20 TO PRT.                                    C2631
11200      MOVE ZERO TO C-CTL.                                     C2631
11210      PERFORM WRITE-SPOOL.                                    C2631
11220      MOVE HEAD-2 TO PRT.                                     C2631
11230      MOVE ' ' TO C-CTL.                                      C2631
11240      PERFORM WRITE-SPOOL.                                    C2631
11250      MOVE SPACE TO PRT.                                      C2631
11260      MOVE ' ' TO C-CTL.                                      C2631
11270      PERFORM WRITE-SPOOL.                                    C2631
11280      MOVE ZERO TO LINCNT.                                    C2631
11290      NOTE END OF PERFORMED ROUTINE.                          C2631
11300                                                              C2631
11310  PRINT-LINE SECTION.                                         C2631
11320      IF REC (3) = 1  AND REC (4) LESS THAN 2                 C2631
11330          ADD 1 TO DT-AREC.                                   C2631
11340          GO TO PRINT-LINE-EXIT.                              C2631
11350      IF (MODEM (2) = 6 OR MODEM (2) = 5)  AND                C2631
11360          (MODEM (3) = 6 OR MODEM (3) = 5)                    C2631
11370          AND MODES (2) NOT = MODES (3)                       C2631
11380              MOVE 6 TO MODEM (2), MODEM (3).                 C2631
11390              MOVE 'ACC-GEAR' TO MODED (2), MODED (3).        C2631
11400      IF MODEM (2) = 5 AND                                    C2631
11410          MODEM (3) = 6                                       C2631
11420              MOVE 6 TO MODEM (2).                            C2631
11430              MOVE 'ACC-GEAR' TO MODED (2).                   C2631
11440      IF  T-MODE (2) = T-MODE (3)                             C2631
11450              MOVE FN-TIME (2) TO FN-TIME (3).                C2631
11460              MOVE FIN-SPD (2) TO FIN-SPD (3).                C2631
11470              ADD REC (2) TO REC (3).                         C2631
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9 - MODE PROFILE (cont'd)

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11400              GO TO PRINT-LINE-EXIT-1.                        C2631
           IF REC (4) LESS THAN 2
               GO TO PRINT-LINE-EXIT.
11490      IF LINCNT GREATER THAN 50 PERFORM OVRFL.                C2631
11500      IF Z-REC (4) = 'Z'
12010          MOVE 'ZERO' TO DT-ZERO   ELSE                       C2631
12020              MOVE SPACE TO DT-ZERO.                          C2631
12030      MOVE ST-TIME (4) TO DT-STIME.
12040      MOVE FN-TIME (4) TO DT-FTIME.
12050      MOVE T-MODE (4) TO DT-MODE.
12060      MOVE MODED (4) TO DT-MODED.
12070                                                              C2631
12100      MOVE 1 TO X1.                                           C2631
12110      IF SM-RT (4, 1) LESS THAN SM-RT (4, 2)
12120    .     MOVE 2 TO X1.                                       C2631
12130          MOVE SM-RT (4, 2) TO SM-RT (4, 1).
12140      IF SM-RT (4, 1) LESS THAN SM-RT (4, 3)
12150          MOVE 3 TO X1.                                       C2631
12160      MOVE DT-MODES TO X2.                                    C2631
12170      IF SM-RT (4, 1) = ZERO AND
12180          SM-RT (4, 2) = ZERO AND
12190          SM-RT (4, 3) = ZERO
12200              MOVE 4 TO X1.                                   C2631
12210      ADD REC (4) TO RD-TIM (X2, X1).
12220      ADD SM-SPD (4) TO RD-SPD (X2, X1).
12240                                                              C2631
12250      COMPUTE TW4 = FIN-SPD (4) - INIT-SPD (4).
12260      IF (DT-MODEX = 04 OR DT-MODEX = 05)      AND            C2631
12270         (TW4 NEGATIVE OR TW4 = ZERO)                         C2631
12280             COMPUTE FIN-SPD (4) = MAX-SPD (4).
12290      IF (DT-MODEX GREATER THAN 06)    AND                    C2631
12300         (TW4 POSITIVE OR TW4 = ZERO)                         C2631
12310             COMPUTE FIN-SPD (4) = MIN-SPD (4).
12320      COMPUTE TW4 = INIT-SPD (4).
12330      COMPUTE TW5 = FIN-SPD (4).
12340      IF DT-MODEX LESS THAN 04                                C2631
12350          MOVE ZERO TO TW4, TW5.                              C2631
12360      COMPUTE DT-IN-SPD = TW4.                                C2631
12370      COMPUTE DT-FN-SPD = TW5.                                C2631
12380      SUBTRACT TW4 FROM TW5.                                  C2631
12390      COMPUTE DT-CH-SPD = TW5.                                C2631
12400      COMPUTE TW1 ROUNDED = REC (4) * 0.88.
12410      MOVE SPACE TO DT-RATE-CH, DT-XINTENSITY.                C2631
12420      IF DT-MODEX LESS THAN 04                                C2631
12430              GO TO PRINT-LINE-1.                             C2631
12440      COMPUTE TW4 ROUNDED = TW5 / TW1.                        C2631
12450      COMPUTE DT-RATE-CH = TW4.                               C2631
12460      IF DT-MODEX = 10 OR  DT-MODEX = 04                      C2631
12470          GO TO PRINT-LINE-1.                                 C2631
12480      COMPUTE TW4 ROUNDED = TW4 / 0.2.                        C2631
12490      MOVE TW4 TO INTENS.                                     C2631
12500      COMPUTE DT-INTENSITY = TW4.                             C2631
13010  PRINT-LINE-1.                                               C2631
13020      MOVE SPACE TO DT-HRX.                                   C2631
13030      COMPUTE TW2 = TW1 / 3600.                               C2631
13040      COMPUTE DT-TH = TW2.                                    C2631
13050      COMPUTE TW1 = TW1 - (TW2 * 3600).                       C2631
13060      COMPUTE TW2 = TW1 / 60.                                 C2631
13070      COMPUTE DT-TM = TW2.                                    C2631
13080      COMPUTE TW1 = TW1 - (TW2 * 60).                         C2631
13090      COMPUTE DT-TS = TW1.                                    C2631
13100      MOVE REC (4) TO DT-RECF.
13110      MOVE DT-AREC TO DT-ARECP.                               C2631
13120      IF DT-MODEX = 07  OR                                    C2631
13130          DT-MODEX = 08   OR                                  C2631
13140          DT-MODEX = 09                                       C2631
13150              ADD DEC-VC (4) TO SUM-VC.
13160  CREATE-SLM-HORSEPOWER-CRUISE.                               C2631
13170      IF DT-MODEX NOT = 04                                    C2631
13180          GO TO CREATE-INTENSITY-RECORD.                      C2631
13190      MOVE SPACE TO TAPOT-REC.                                C2631
13200      MOVE 6 TO O-FLAG.                                       C2631
13210      MOVE 6 TO O-FLAGS.                                      C2631
13220      MOVE 1 TO O-FREQ.                                       C2631
13230      MOVE HP-SUM (4) TO O-TIME, DT-HF.
13240      COMPUTE C-FMODE = 50.00 + DT-MODE99.                    C2631
13250      WRITE TAPOT-REC.                                        C2631
13260  CREATE-INTENSITY-RECORD.                                    C2631
13270      IF DT-MODEX LESS THAN 05 OR DT-MODEX GREATER THAN 09    C2631
13280              GO TO PRINT-LINE-2.                             C2631
13290      MOVE SPACE TO TAPOT-REC.                                C2631
13300      MOVE 6 TO O-FLAG.                                       C2631
13310      IF DT-MODEX = 05 OR DT-MODEX = 06                       C2631
13320      MOVE 1 TO O-FLAGS.                                      C2631
13330      IF DT-MODEX = 07 MOVE 2 TO O-FLAGS.                     C2631
13340      IF DT-MODEX = 08 MOVE 3 TO O-FLAGS.                     C2631
13350      IF DT-MODEX = 09 MOVE 4 TO O-FLAGS.                     C2631
13360      COMPUTE O-TIME = REC (4) * 0.88.
13370      MOVE 1 TO O-FREQ.                                       C2631
13380      IF INTENS GREATER THAN 05.1 GO TO CREATE-INTENSITY-MIDDLE.  C2631
13390      IF INTENS LESS THAN 00.6                                C2631
13400          MOVE 01 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
13410      IF INTENS LESS THAN 01.1                                C2631
13420          MOVE 02 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
13430      IF INTENS LESS THAN 01.6                                C2631
13440          MOVE 03 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
13450      IF INTENS LESS THAN 02.1                                C2631
13460          MOVE 04 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
13470      IF INTENS LESS THAN 02.6                                C2631
13480          MOVE 05 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
13490      IF INTENS LESS THAN 03.1                                C2631
13500          MOVE 06 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
14010      IF INTENS LESS THAN 03.6                                C2631
14020          MOVE 07 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
14030      IF INTENS LESS THAN 04.1                                C2631
14040          MOVE 08 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
14050  CREATE-INTENSITY-MIDDLE.                                    C2631
14060      IF INTENS LESS THAN 05.1                                C2631
14070          MOVE 09 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
14080      IF INTENS LESS THAN 06.1                                C2631
14090          MOVE 10 TO SUB-MODE,  GO TO CREATE-INTENSITY-1.     C2631
14100      IF INTENS LESS THAN 07.1                                C2631
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9 - MODE PROFILE (cont'd)

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14110          MOVE 11 TO SUB-MCDE.  GC TC CREATE-INTENSITY-1.
14120      IF INTENS LESS THAN 08.1                                    C2631
14130          MOVE 12 TO SUB-MODE.  GC TC CREATE-INTENSITY-1.         C2631
14140      IF INTENS LESS THAN 09.1                                    C2631
14150          MOVE 13 TO SUB-MODE.  GC TC CREATE-INTENSITY-1.         C2631
14160      IF INTENS LESS THAN 10.1                                    C2631
14170          MOVE 14 TO SUB-MODE.  GC TC CREATE-INTENSITY-1.         C2631
14180      IF INTENS LESS THAN 11.1                                    C2631
14190          MOVE 15 TO SUB-MODE.  GO TC CREATE-INTENSITY-1.         C2631
14200      IF INTENS LESS THAN 12.1                                    C2631
14210          MOVE 16 TO SUB-MODE.  GC TC CREATE-INTENSITY-1.         C2631
14220      IF INTENS LESS THAN 15.1                                    C2631
14230          MOVE 17 TO SUB-MODE.  GC TC CREATE-INTENSITY-1.         C2631
14240      IF INTENS LESS THAN 20.1                                    C2631
14250          MOVE 18 TO SUB-MODE.  GC TC CREATE-INTENSITY-1.         C2631
14260      MCVE 19 TC SUB-MODE.                                        C2631
14270  CREATE-INTENSITY-1.                                             C2631
14280      CCMPUTE O-FMODE = 50.0C + SUB-MCDE-1.                       C2631
14290      WRITE TAPOT-REC.                                            C2631
14300  CREATE-SUM-HCRSEPOWER-ACC.                                      C2631
14310      IF CT-MODEX LESS THAN C5 CR                                 C2631
14320          DT-MODEX GREATER THAN 06                                C2631
14330              GC TO PRINT-LINE-2.                                 C2631
14340      MCVE SPACE TC TAPOT-REC.                                    C2631
14350      MCVE 6 TC O-FLAG.                                           C2631
14360      MCVE 5 TC O-FLAGS.                                          C2631
14370      MCVE 1 TC O-FREQ.                                           C2631
14380      MCVE HP-SUM (4) TO O-TIME, CT-MF.                           C2631
14390      CCMPUTE C-FMODE = 50.0C + SUB-MCDE-1.
14400      WRITE TAPOT-REC.                                            C2631
14410  PRINT-LINE-2.                                                   C2631
14420      MCVE DET-LINE TO PRT.                                       C2631
14430      MOVE ' ' TO C-CTL.                                          C2631
14440      PERFORM WRITE-SPOOL.                                        C2631
14450C     ACC REC (4) TO DT-AREC.                                     C2631
14460      ACD 1 TO LINCNT.
144702     MCVE SPACE TO TAPOT-REC.                                    C2631
14480      MCVE 8 TO O-FLAG.                                           C2631
144909     MCVE T-MODE (4) TO C-FMODE.                                 C2631
14500C     MCVE T-MODE (3) TO C-TPCDE.
15010      CCMPUTE O-TIMF = REC (4) * 0.88.
15020      MCVE O-TIME TO H-TIME.
15030      MCVE 1 TO O-FREQ.                                           C2631
15040      IF FIRST-SWITCH = 5 GC TC PRINT-LINE-EXIT.                  C2631
15170      PERFORM LOAD-TOTALS.                                        C2631
15180  WRITE-CP.                                                       C2631
15190      MCVE 3 TO O-FLAGS.                                          C2631
15200      WRITE TAPOT-REC.                                            C2631
15210      GC TO PRINT-LINE-EXIT.                                      C2631
15220  PRINT-LINE-EXIT-1.                                              C2631
15230      IF MIN-SPD (2) LESS THAN MIN-SPC (3)                        C2631
15240          MOVE MIN-SPD (2) TC MIN-SPD (3).                        C2631
15250      IF MAX-SPD (2) GREATER THAN MAX-SPD (3)                     C2631
15260          MCVE MAX-SPD (2) TC MAX-SPC (3).                        C2631
15270      IF Z-REC (2) = 'Z'                                          C2631
15280          MCVE 'Z' TO Z-REC (3).                                  C2631
                                                                       C2631

15290      ACC SM-SPD (3) TO SM-SPD (2).
15300      ACC SM-RT (3, 1) TC SM-RT (2, 1).                           C2631
15310      ACC SM-RT (3, 2) TC SM-RT (2, 2).                           C2631
15320      ACD SM-RT (3, 3) TC SM-RT (2, 3).                           C2631
15330      MCVE C-TABLE (3) TC C-TABLE (2).                            C2631
           MCVE C-TABLE (4) TC C-TABLE (3).                            C2631
           MOVE SM-RT1 (4) TO SM-RT1 (3).
           MCVE SM-SPD (4) TC SM-SPD (3).
15340  PRINT-LINE-EXIT.
15350      EXIT.                                                       C2631
15360                                                                  C2631
15370  FIND-MODE SECTION.                                              C2631
15380      ACD 1 TO RECNO.                                             C2631
15390      IF CPT1 LESS THAN 3                                         C2631
15400      DISPLAY '**   **   **   **   **   **   **   ',             C2631
15410          RECNO, '   **   **   **   **   **   **   **   **'.      C2631
15420      IF CPT1 = 2                                                 C2631
15430      READY TRACE.                                                C2631
15440      IF OPT1 LESS THAN 3                                         C2631
15450      EXHIBIT NAMED T-VS, T-LF, INIT-VS, HOLC-MODE.               C2631
15460      MOVE 0.0 TO H-VS-RPM.                                       C2631
15480      IF T-VS  NOT = C.0                                          C2631
15470          COMPUTE H-VS-RPM = T-RFP / T-VS.                        C2631
15490      IF FORCE-ACC NOT = ZERC                                     C2631
15500          MOVE SPACE TO INIT-CHECK,                               C2631
16010          GO TO CHECK-MODE-ACC-2.                                 C2631
16020      IF FORCE-DEC NOT = ZERG                                     C2631
16030          MOVE SPACE TO INIT-CHECK,                               C2631
16040          GO TC DECELERATE-2.                                     C2631
16050      MCVE ZERO TO INIT-CHECK.                                    C2631
16060      IF FIRST-SWITCH = ZERO GG TC MODE-IDLE.                     C2631
16070      ALTER COMMON-GO-TO TO PROCEED TC NCT-SAME-AS-LAST.          C2631
16080      IF HOLD-MODE LESS THAN 04 GO TO CHECK-MODE-IDLE-SOAK-STOP.  C2631
16090      IF HOLD-MODE = 04 GO TC CHECK-MCDE-CRUISE.                  C2631
16100      IF HOLD-MODE = 05 CR HOLD-MCDE = 06                         C2631
16110          GO TO CHECK-MODE-ACCELERATICN.                          C2631
16120      IF HOLD-MODE LESS THAN 10 GO TC CHECK-MODE-DECELERATION.    C2631
16130      IF HOLD-MODE = 10 GO TO CHECK-MCDE-COAST.                   C2631
16140  NOT-SAME-AS-LAST.                                               C2631
16150      MOVE SPACE TO INIT-CHECK.                                   C2631
16160      ALTER COMMON-GO-TC  TO PRCCEED TC CHECK-1.                  C2631
16170      GC TC CHECK-MODE-ICLE-SCAK-STCP.                            C2631
16180  CHECK-1.                                                        C2631
16190      ALTER COMMON-GO-TC  TC PRCCEED TC CHECK-2.                  C2631
16200      GO TO CHECK-MODE-CRUISE.                                    C2631
16210  CHECK-2.                                                        C2631
16220      ALTER COMMON-GO-TO  TO PROCEED TC CHECK-3.                  C2631
16230      GO TO CHECK-MODE-ACCELERATICN.                              C2631
16240  CHECK-3.                                                        C2631
16250      ALTER COMMON-GO-TO  TO PRCCEEC TO CHECK-4.                  C2631
16260      GC TO CHECK-MODE-DECELERATICN.                              C2631
16270  CHECK-4.                                                        C2631
16280      ALTER COMMON-GO-TO  TO PROCEED TC CHECK-5.                  C2631
16290      GC TO CHECK-MODE-COAST.                                     C2631
16300  CHECK-5.                                                        C2631
16310  ALL-FAILEC.                                                     C2631
                                                                       C2631
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9 - MODE PROFILE (cont'd)

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16320          GO TO MODE-CUT.                                              C2631
16330                                                                       C2631
16340                                                                       C2631
16350      COMMON-GO-TO.                                                    C2631
16360          GO TO.                                                       C2631
16370                                                                       C2631
16380                                                                       C2631
16390      CHECK-MODE-IDLE-SOAK-STOP.                                       C2631
16400          IF T-VS NOT LESS THAN 0.5                                    C2631
16410              GO TO COMMON-GO-TO.                                      C2631
16420          IF T-RPM GREATER THAN 200.0                                  C2631
16430              GO TO MODE-IDLE.                                         C2631
16440          IF T-TMP GREATER THAN AMBIENT-PLUS-FIFTY                     C2631
16450              GO TO MODE-HOT-SOAK.                                     C2631
16460          GO TO MODE-STOP.                                             C2631
16470                                                                       C2631
16480                                                                       C2631
16490      CHECK-MODE-CRUISE.                                               C2631
16500          IF T-VS GREATER THAN (INIT-VS + 2.5)                         C2631
17010              GO TO CHECK-MODE-ACCELERATION.                           C2631
17020          IF T-VS  LESS   THAN (INIT-VS - 2.5)      OR                 C2631
17030                T-LF LESS THAN 1.0                                     C2631
17040                  GO TO CHECK-MODE-DECELERATION.                       C2631
17050      FORCE-CRUISE.                                                    C2631
17060          COMPUTE SUB-MODE ROUNDED = ((T-VS - 1.0) / 5.0.              C2631
17070          ADD 1 TO SUB-MODE.                                           C2631
17080          IF SUB-MODE GREATER THAN 17                                  C2631
17090              MOVE 17 TO SUB-MODE.                                     C2631
17100          COMPUTE NEW-MODE = 4.00 + SUB-MODE-1.                        C2631
17110          GO TO MODE-CRUISE.                                           C2631
17120                                                                       C2631
17130                                                                       C2631
17140      CHECK-MODE-ACCELERATION.                                         C2631
17150          IF T-RPM NOT GREATER THAN 200.0                              C2631
17160              GO TO FORCE-CRUISE.                                      C2631
17170          MOVE LOOK-AHEAD TO FORCE-ACC.                                C2631
17180      CHECK-MODE-ACC-1.                                                C2631
17190          IF FORCE-ACC = 1                                             C2631
17200              MOVE ZERO TO FORCE-ACC,                                  C2631
17210              GO TO FORCE-CRUISE.                                      C2631
17220          IF ((S-VS (FORCE-ACC) - T-VS) / (FORCE-ACC - 1.00))          C2631
17230              IS GREATER THAN 0.176                                    C2631
17240              GO TO CHECK-MODE-ACC-2.                                  C2631
17250          SUBTRACT 1 FROM FORCE-ACC.                                   C2631
17260          GO TO CHECK-MODE-ACC-1.                                      C2631
17270      CHECK-MODE-ACC-2.                                                C2631
17280          SUBTRACT 1 FROM FORCE-ACC.                                   C2631
17290          IF FORCE-ACC = ZERO                                          C2631
17300              MOVE LOOK-AHEAD TO FORCE-ACC,                            C2631
17310              GO TO CHECK-MODE-ACC-4.                                  C2631
17320      CHECK-MODE-ACC-3.                                                C2631
17330          IF M-VS-RPM LESS THAN GEAR5                                  C2631
17340              MOVE 05 TO SUB-MODE,                                     C2631
17350              GO TO MODE-ACCELERATION.                                 C2631
17360          IF M-VS-RPM LESS THAN GEAR4                                  C2631
17370              MOVE 04 TO SUB-MODE,                                     C2631
17380              GO TO MODE-ACCELERATION.                                 C2631
17390          IF M-VS-RPM LESS THAN GEAR3                                  C2631
17400              MOVE 03 TO SUB-MODE,                                     C2631
17410              GO TO MODE-ACCELERATION.                                 C2631
17420          IF M-VS-RPM LESS THAN GEAR2                                  C2631
17430              MOVE 02 TO SUB-MODE,                                     C2631
17440              GO TO MODE-ACCELERATION.                                 C2631
17450          MOVE 01 TO SUB-MODE.                                         C2631
17460          GO TO MODE-ACCELERATION.                                     C2631
17470      CHECK-MODE-ACC-4.                                                C2631
17480          IF FORCE-ACC = 1                                             C2631
17490              SUBTRACT 1 FROM FORCE-ACC,                               C2631
17500              GO TO CHECK-MODE-ACC-3.                                  C2631
18010          IF ((S-VS (FORCE-ACC) - T-VS) / (FORCE-ACC - 1.00))          C2631
18020              IS GREATER THAN 0.176                                    C2631
18030              MOVE ZERO TO FORCE-ACC,                                  C2631
18040              GO TO CHECK-MODE-ACC-3.                                  C2631
18050          SUBTRACT 1 FROM FORCE-ACC.                                   C2631
18060          GO TO CHECK-MODE-ACC-4.                                      C2631
18070                                                                       C2631
18080                                                                       C2631
18090      CHECK-MODE-DECELERATION.                                         C2631
18100          IF T-VS LESS THAN (LAST-VS - 0.176)                          C2631
18110              NEXT SENTENCE      ELSE                                  C2631
18120                  GO TO CHECK-MODE-COAST.                              C2631
18130          IF T-LF LESS THAN 0.0     OR                                 C2631
18140              T-LF = 0.0                                               C2631
18150              GO TO MODE-DECELERATE-DYNAMIC.                           C2631
18160          MOVE LOOK-AHEAD TO FORCE-DEC.                                C2631
18170      DECELERATE-1.                                                    C2631
18180          IF FORCE-DEC = 1                                             C2631
18190              MOVE ZERO TO FORCE-DEC,                                  C2631
18200              GO.TO CHECK-MODE-COAST.                                  C2631
18210          IF ((S-VS (FORCE-DEC) - T-VS) / (FORCE-DEC - 1.00))          C2631
18220              IS LESS THAN -0.176                                      C2631
18230              GO TO DECELERATE-2.                                      C2631
18240          SUBTRACT 1 FROM FORCE-DEC.                                   C2631
18250          GO TO DECELERATE-1.                                          C2631
18260      DECELERATE-2.                                                    C2631
18270          SUBTRACT 1 FROM FORCE-DEC.                                   C2631
18280          IF FORCE-DEC = ZERO                                          C2631
18290              MOVE LOOK-AHEAD TO FORCE-DEC,                            C2631
18300              GO TO DECELERATE-4.                                      C2631
18310          NOTE                                                         C2631
18320          PERFORM GET-AVERAGE-SPEED-CHANGE.                            C2631
18330          NOTE * * * *                                                 C2631
18340          IF AVG-SPEED-CHANGE LESS THAN -0.176                         C2631
18350              NEXT SENTENCE      ELSE                                  C2631
18360                  GO TO CHECK-MODE-COAST.                              C2631
18370      DECELERATE-3.                                                    C2631
               IF (VC-SWITCH = "L" AND
                   T-VC LESS THAN 0.200)
                     OR
                  (VC-SWITCH = "H" AND
                     T-VC NOT LESS THAN 0.200)
18390              GO TO MODE-DECELERATE-THROTTLE.                          C2631
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9 - MODE PROFILE (cont'd)

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    GO TO MODE-DECELERATE-POWER.                              C2631
DECELERATE-4.                                                 C2631
    IF FORCE-DEC = 1                                          C2631
        MOVE ZERO TO FORCE-DEC.                               C2631
        GO TO DECELERATE-3.                                   C2631
    IF ((T-VS (FORCE-DEC) - T-VS) / (FORCE-DEC - 1.00))       C2631
        IS LESS THAN -0.176                                   C2631
        SUBTRACT 1 FROM FORCE-DEC,                            C2631
        GO TO DECELERATE-3.                                   C2631
    SUBTRACT 1 FROM FORCE-DEC.                                C2631
    GO TO DECELERATE-4.                                       C2631
                                                              C2631
                                                              C2631
CHECK-MODE-COAST.                                             C2631
    IF T-VS LESS THAN 0.5                                     C2631
        GO TO COMMON-GO-TO.                                   C2631
    IF T-VS LESS THAN LAST-VS                                 C2631
        NEXT SENTENCE   ELSE                                  C2631
            GO TO COAST-1.                                    C2631
    PERFORM GET-SUB-MODE.                                     C2631
    COMPUTE NEW-MODE = 10.00 + SUB-MODE-1.                    C2631
    GO TO MODE-COAST.                                         C2631
COAST-1.                                                      C2631
    GO TO CHECK-MODE-ACCELERATION.                            C2631
                                                              C2631
                                                              C2631
                                                              C2631
MODE-IDLE.                                                    C2631
    MOVE 01 TO HOLD-MODE.                                     C2631
    MOVE 01.00 TO MODX.                                       C2631
    MOVE 'IDLE' TO M-DESC.                                    C2631
    GO TO MODE-OUT.                                           C2631
MODE-STOP.                                                    C2631
    MOVE 02 TO HOLD-MODE.                                     C2631
    MOVE 02.00 TO MODX.                                       C2631
    MOVE 'STOP' TO M-DESC.                                    C2631
    GO TO MODE-OUT.                                           C2631
MODE-HOT-SOAK.                                                C2631
    MOVE 03 TO HOLD-MODE.                                     C2631
    MOVE 03.00 TO MODX.                                       C2631
    MOVE 'HOT-SOAK' TO M-DESC.                                C2631
    GO TO MODE-OUT.                                           C2631
MODE-COAST.                                                   C2631
    MOVE 10 TO HOLD-MODE.                                     C2631
    MOVE NEW-MODE TO MODX.                                    C2631
    MOVE 'COAST' TO M-DESC.                                   C2631
    GO TO MODE-OUT.                                           C2631
MODE-CRUISE.                                                  C2631
    MOVE NEW-MODE TO MODX.                                    C2631
    MOVE 04 TO HOLD-MODE.                                     C2631
    MOVE 'CRUISE' TO M-DESC.                                  C2631
    GO TO MODE-OUT.                                           C2631
MODE-ACCELERATION.                                            C2631
    MOVE 05 TO HOLD-MODE.                                     C2631
    COMPUTE MODX = 5.00 + SUB-MODE-1.                         C2631
    MOVE 'ACCELERATION'                 TO M-DESC.            C2631
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    GO TO MODE-OUT.                                           C2631
MODE-DECELERATE-DYNAMIC.                                      C2631
    MOVE 07 TO HOLD-MODE.                                     C2631
    MOVE 07.00 TO MODX.                                       C2631
    MOVE 'DEC-DYNAMIC'                  TO M-DESC.            C2631
    GO TO MODE-OUT.                                           C2631
MODE-DECELERATE-POWER.                                        C2631
    MOVE 08 TO HOLD-MODE.                                     C2631
    MOVE 08.00 TO MODX.                                       C2631
    MOVE 'DEC-POWER'                    TO M-DESC.            C2631
    GO TO MODE-OUT.                                           C2631
MODE-DECELERATE-THROTTLE.                                     C2631
    MOVE 09 TO HOLD-MODE.                                     C2631
    MOVE 09.00 TO MODX.                                       C2631
// PAUSE
    MOVE 'DEC-THROT-CLSD'               TO M-DESC.            C2631
    GO TO MODE-OUT.                                           C2631
MODE-OUT.                                                     C2631
    IF CPT1 LESS THAN 3                                       C2631
    EXHIBIT NAMED MODX, LAST-MODX, LAST-VS, INIT-CHECK.       C2631
    IF INIT-CHECK = ZERO                AND                   C2631
        MODX NOT = LAST-MODX                                  C2631
        MOVE ZERO TO FORCE-ACC, FORCE-DEC,                    C2631
            GO TO COMMON-GO-TO.                               C2631
    MOVE H-VS-RPM TO LAST-VS-RPM.                             C2631
    MOVE T-VS TO LAST-VS.                                     C2631
    MOVE MODX TO LAST-MODX.                                   C2631
    IF CPT1 = 2                                               C2631
    RESET TRACE.                                              C2631
MODE-OUT-X.                                                   C2631
    EXIT.                                                     C2631
                                                              C2631
                                                              C2631
GET-AVERAGE-SPEED-CHANGE SECTION.                             C2631
    MOVE ZERO TO AVG-SPEED-CHANGE.                            C2631
    MOVE 1 TO X1.  MOVE 2 TO X2.                              C2631
    IF REC-LEFT LESS THAN 1 GO TO AVG-EXIT.                   C2631
    PERFORM COMPUTE-DIF REC-LEFT TIMES.                       C2631
    DIVIDE REC-LEFT INTO AVG-SPEED-CHANGE.                    C2631
    GO TO AVG-EXIT.                                           C2631
COMPUTE-DIF.                                                  C2631
    COMPUTE AVG-SPEED-CHANGE = AVG-SPEED-CHANGE +             C2631
        S-VS (X2) - S-VS (X1).                                C2631
    ADD 1 TO X1.            ADD 1 TO X2.                      C2631
AVG-EXIT.                                                     C2631
    EXIT.                                                     C2631.
                                                              C2631
                                                              C2631
GET-RECORD SECTION.                                           C2631
    IF EOR-SWITCH = 1 GO TO FLUSH-RECORD.                     C2631
    READ TAPIN AT END                                         C2631
        MOVE 1 TO EOR-SWITCH,                                 C2631
        GO TO FLUSH-RECORD.                                   C2631
   .ADD 1 TO REC-LEFT.                                        C2631
FLUSH-RECORD.                                                 C2631
    MOVE S-TAPIN-REC (2) TO                                   C2631
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9 - MODE PROFILE (cont'd)

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21010          S-TAPIN-REC (1), W-TAPIN-REC.                                 C2631
21020      MOVE S-TAPIN-REC (3) TO                                           C2631
21030          S-TAPIN-REC (2).                                              C2631
21040      IF EOR-SWITCH NOT = 1                                             C2631
21050          MOVE TAPIN-REC TO S-TAPIN-REC (3).                            C2631
21060      MOVE REC-LEFT TO LOOK-AHEAD.                                      C2631
21070      SUBTRACT 1 FROM REC-LEFT.                                         C2631
21080      IF REC-LEFT LESS THAN ZERO                                        C2631
21090          MOVE 1 TO EOF-SWITCH.                                         C2631
21100  GET-RECORD-EXIT.                                                      C2631
21110      EXIT.                                                             C2631
21120                                                                        C2631
21130                                                                        C2631
21140  GET-SUB-MODE SECTION.                                                 C2631
21150      MOVE 6 TO SUB-MODE.                                               C2631
21160      IF T-VS LESS THAN 11.0 MOVE 1 TO SUB-MODE,                        C2631
21170          GO TO GET-SUB-MODE-EXIT.                                      C2631
21180      IF T-VS LESS THAN 21.0 MOVE 2 TO SUB-MODE,                        C2631
21190          GO TO GET-SUB-MODE-EXIT.                                      C2631
21200      IF T-VS LESS THAN 31.0 MOVE 3 TO SUB-MODE,                        C2631
21210          GO TO GET-SUB-MODE-EXIT.                                      C2631
21220      IF T-VS LESS THAN 41.0 MOVE 4 TO SUB-MODE,                        C2631
21230          GO TO GET-SUB-MODE-EXIT.                                      C2631
21240      IF T-VS LESS THAN 51.0 MOVE 5 TO SUB-MODE,                        C2631
21250          GO TO GET-SUB-MODE-EXIT.                                      C2631
21260  GET-SUB-MODE-EXIT.       EXIT.                                        C2631
21270                                                                        C2631
21280  LOAD-TOTALS SECTION.                                                  C2631
21290      COMPUTE X1 = MODEM (4).
21300      COMPUTE X2 = MODEM (3).
21310      ADD 1 TO MT-MFREQ (X1, X2).                                       C2631
21320      ADD W-TIME TO MT-MTIME (X1, X2).                                  C2631
21330      MOVE X4 TO X1.                                                    C2631
21340  LOAD-TOTALS-1.                                                        C2631
21350      IF MT-FMODE (X1) = ZERO                                           C2631
21360          MOVE T-MODE (4) TO MT-FMODE (X1).
21370          MOVE T-MODE (3) TO MT-TMODE (X1).
21380          MOVE 1 TO MT-SFREQ (X1).                                      C2631
21390          ADD W-TIME TO MT-STIME (X1).                                  C2631
21400          GO TO LOAD-TOTALS-2.                                          C2631
21410      IF MT-FMODE (X1) = T-MODE (4)    AND
21420          MT-TMODE (X1) = T-MODE (3),
21430              ADD 1 TO MT-SFREQ (X1).                                   C2631
21440              ADD W-TIME TO MT-STIME (X1).                              C2631
21450              GO TO LOAD-TOTALS-2.                                      C2631
21460      ADD 1 TO X1.                                                      C2631
21470      IF X1 = X6                                                        C2631
21480          MOVE TAPOT-REC TO TAPOT-HOLD.                                 C2631
21490          MOVE X4 TO X1.                                                C2631
21500          PERFORM DUMP-STOTALS X6  TIMES.                               C2631
22010          MOVE X4 TO X1.                                                C2631
22020          PERFORM CLEARS X6  TIMES.                                     C2631
22030          MOVE X4 TO X1.                                                C2631
22040          MOVE TAPOT-HOLD TO TAPOT-REC.                                 C2631
22050      GO TO LOAD-TOTALS-1.                                              C2631
22060  LOAD-TOTALS-2.                                                        C2631
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22070      MOVE X3 TO X1.                                                    C2631
22080  LOAD-TOTALS-3.                                                        C2631
22090      IF W-TIME = ZERO                                                  C2631
22100          GO TO LOAD-TOTALS-EXIT.                                       C2631
22110      IF MT-FMODE (X1) = ZERO                                           C2631
22120          MOVE T-MODE (4) TO MT-FMODE (X1).
22130          MOVE 1 TO MT-SFREQ (X1).                                      C2631
22140          ADD W-TIME TO MT-STIME (X1).                                  C2631
22150          GO TO LOAD-TOTALS-EXIT.                                       C2631
22160      IF MT-FMODE (X1) = T-MODE (4)
22170              ADD 1 TO MT-SFREQ (X1).                                   C2631
22180              ADD W-TIME TO MT-STIME (X1).                              C2631
22190              GO TO LOAD-TOTALS-EXIT.                                   C2631
22200      ADD 1 TO X1.                                                      C2631
22210      IF X1 = X5                                                        C2631
22220          MOVE TAPOT-REC TO TAPOT-HOLD.                                 C2631
22230          MOVE X3 TO X1.                                                C2631
22240          PERFORM DUMP-STOTALS X5  TIMES.                               C2631
22250          MOVE X3 TO X1.                                                C2631
22260          PERFORM CLEARS X5  TIMES.                                     C2631
22270          MOVE X3 TO X1.                                                C2631
22280          MOVE TAPOT-HOLD TO TAPOT-REC.                                 C2631
22290      GO TO LOAD-TOTALS-3.                                              C2631
22300  LOAD-TOTALS-EXIT.                                                     C2631
22310      EXIT.                                                             C2631
22320                                                                        C2631
22330  DUMP-TRAF SECTION.                                                    C2631
22340      MOVE SPACE TO TAPOT-REC.                                          C2631
22350      COMPUTE O-FMODE = 8.00 + X1 / 100.                                C2631
22360      MOVE TRAF-4 (X1) TO O-TIME.                                       C2631
22370      MOVE ZERO TO O-FREQ.                                              C2631
22380      MOVE 7 TO O-FLAG.                                                 C2631
22390      MOVE 1 TO O-FLAGS.                                                C2631
22400      IF O-TIME NOT = ZERO                                              C2631
22410          WRITE TAPOT-REC.                                              C2631
22420      ADD 1 TO X1.                                                      C2631
22430                                                                        C2631
22440                                                                        C2631
22450  DUMP-ROAD SECTION.                                                    C2631
22460      MOVE 1 TO X2.                                                     C2631
22470      PERFORM DUMP-ROAD-1 4 TIMES.                                      C2631
22480      ADD 1 TO X1.                                                      C2631
22490      GO TO DUMP-ROAD-EXIT.                                             C2631
22500  DUMP-ROAD-1.                                                          C2631
23020      MOVE SPACE TO TAPOT-REC.                                          C2631
23030      COMPUTE O-FMODE = X1 + X2 / 100.                                  C2631
23040      MOVE 7 TO O-FLAG.                                                 C2631
23050      MOVE 2 TO O-FLAGS.                                                C2631
23060      COMPUTE O-TIME ROUNDED = RD-SPD (X1, X2).                         C2631
23070      COMPUTE O-FREQ ROUNDED = RD-TIM (X1, X2) * 0.60.                  C2631
23110      ADD 1 TO X2.                                                      C2631
23120      IF O-FREQ NOT = ZERO                                              C2631
23130          WRITE TAPOT-REC.                                              C2631
23140  DUMP-ROAD-EXIT.                                                       C2631
23150      EXIT.                                                             C2631
23160                                                                        C2631
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9 - MODE PROFILE (cont'd)

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23170  END-FILE SECTION.                                   C2631
           PERFORM PRINT-LINE.
           MOVE C-TABLE (3) TO C-TABLE (4).
           MOVE C-TABLE (2) TO C-TABLE (3).
           MOVE C-TABLE (1) TO C-TABLE (2).
           MOVE SM-SPD (3) TO SM-SPD (4).
           MOVE SM-SPD (2) TO SM-SPD (3).
           MOVE SM-SPD (1) TO SM-SPD (2).
           MOVE SM-RT1 (3) TO SM-RT1 (4).
           MOVE SM-RT1 (2) TO SM-RT1 (3).
           MOVE SM-RT1 (1) TO SM-RT1 (2).
23180      PERFORM PRINT-LINE.                             C2631
23190      MOVE C-TABLE (3) TO C-TABLE (4).
23200      MOVE C-TABLE (2) TO C-TABLE (3).
           MOVE SM-SPD (3) TO SM-SPD (4).
           MOVE SM-SPD (2) TO SM-SPD (3).
           MOVE SM-RT1 (3) TO SM-RT1 (4).
           MOVE SM-RT1 (2) TO SM-RT1 (3).
           MOVE 98 TO MODEM (2).
23210      PERFORM PRINT-LINE.                             C2631
23220      MOVE C-TABLE (3) TO C-TABLE (4).
           MOVE SM-SPD (3) TO SM-SPD (4).
           MOVE SM-RT1 (3) TO SM-RT1 (4).
           MOVE 99 TO MODEM (3).
23230      MOVE 9 TO FIRST-SWITCH.                         C2631
23240      PERFORM PRINT-LINE.                             C2631
23250  END-JOB.                                            C2631
23260      MOVE 1 TO X1.                                   C2631
23270      PERFORM DUMP-MTOTALS 10 TIMES.                  C2631
23280      MOVE 1 TO X1.                                   C2631
23290      PERFORM DUMP-STOTALS X7 TIMES.                  C2631
23300      MOVE 1 TO X1.                                   C2631
23310      PERFORM DUMP-TRAF 3 TIMES.                      C2631
23320                                                      C2631
23330  WRITE-ROAD-TYPES.                                   C2631
23340      MOVE 1 TO X1.
23350      PERFORM DUMP-ROAD 10 TIMES.
23360                                                      C2631
23370      MOVE SPACE TO TAPOT-REC.                        C2631
23380      MOVE 6 TO O-FLAG.                               C2631
23390      MOVE 7 TO O-FLAGS.                              C2631
23400      MOVE ZERO TO O-TIME.                            C2631
23410      MOVE SUM-VC TO O-FREQ.                          C2631
23420      MOVE SC.CC TO O-FMCDE.                          C2631
23430      WRITE TAPOT-REC.                                C2631
23440                                                      C2631
23450      CLOSE TAPOT, PRTF,                              C2631
               TAPIN WITH NO REWIND,                       C2631
23470          SPOOL WITH NO REWIND.                       C2631
23480      STOP RUN.
23490  DUMP-MTOTALS.                                       C2631
23500      MOVE 1 TO X2.                                   C2631
24010      PERFORM DUMP-STOTALS1 10 TIMES.                 C2631
24020      ADD 1 TO X1.                                    C2631
24030  DUMP-STOTALS1.                                      C2631
24040      MOVE SPACE TO TAPOT-REC.                        C2631
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24050      COMPUTE C-FMCDE = X1.                           C2631
24060      COMPUTE C-TMODE = X2.                           C2631
24070      MOVE MT-MFREQ (X1, X2) TO C-FREQ.               C2631
24080      MOVE MT-MTIME (X1, X2) TO C-TIME.               C2631
24090      MOVE 5 TO O-FLAG.                               C2631
24100      IF C-FREQ NOT = ZERO                            C2631
24110          WRITE TAPOT-REC.                            C2631
24120      ADD 1 TO X2.                                    C2631
24130  DUMP-STOTALS SECTION.                               C2631
24140      IF MT-FMODE (X1) = ZERO                         C2631
24150          GO TO DUMP-STOTALS2.                        C2631
24160      MOVE SPACE TO TAPOT-REC.                        C2631
24170      MOVE MT-FMODE (X1) TO C-FMCDE.                  C2631
24180      MOVE ZERO TO O-TMODE.                           C2631
24190      MOVE MT-STIME (X1) TO C-TIME.                   C2631
24200      MOVE MT-SFREQ (X1) TO C-FREQ.                   C2631
24210      IF MT-TMCDE (X1) = ZERO                         C2631
24220          MOVE 1 TO O-FLAGS     ELSE                  C2631
24230              MOVE MT-TMCDE (X1) TO C-TMCDE.          C2631
24240              MOVE 2 TO O-FLAGS.                      C2631
24250      MOVE 8 TO O-FLAG.                               C2631
24260      WRITE TAPOT-REC.                                C2631
24270  DUMP-STOTALS2.                                      C2631
24280      ADD 1 TO X1.                                    C2631
24290                                                      C2631
24300  MOVE-HEADER SECTION.                                C2631
24310      READ TAPIN INTO BYTES-1-40  AT END STOP RUN.    C2631
24320      READ TAPIN INTO BYTES-41-80 AT END STOP RUN.    C2631
24330      MOVE M-TRK-ID TO HD3-TRK-ID, T-TRUCK-IDX.       C2631
24340      MOVE M-DAY TO HD3-DAY, T-DAYX.                  C2631
24350      MOVE '*****' TO HD3-CITY.                       C2631
24360      IF M-CITY = ZERO MOVE 'N.Y.' TO HD3-CITY.       C2631
24370      IF M-CITY = 1 MOVE 'L.A.' TO HD3-CITY.          C2631
24380      MOVE M-TYP-TRK TO HD3-TYP.                      C2631
24390      MOVE 'OTHER ' TO HD3-FUEL.                      C2631
24400      IF M-FUEL = ZERO MOVE 'GAS   ' TO HD3-FUEL.     C2631
24410      IF M-FUEL = 1 MOVE 'DIESEL' TO HD3-FUEL.        C2631
24420      MOVE M-WEIGHT TO HD3-WT.                        C2631
24430      MOVE M-LICENSE TO HD3-LICENSE.                  C2631
24440      MOVE M-IND TO HD3-IND.                          C2631
24450      MOVE M-ENGINE TO HD4-ENGINE.                    C2631
24460      MOVE M-SERIAL TO HD4-SERIAL.                    C2631
24470      MOVE M-NDAYS TO HD4-NDAYS.                      C2631
24480      MOVE TRK-OT-1 (1) TO TAPOT-REC.                 C2631
24490      MOVE  1   TO O-FLAG.  WRITE TAPOT-REC.          C2631
24500      MOVE TRK-OT-1 (2) TO TAPOT-REC.                 C2631
25010      MOVE  2   TO O-FLAG.  WRITE TAPOT-REC.          C2631
25020      MOVE TRK-OT-1 (3) TO TAPOT-REC.                 C2631
25030      MOVE  3   TO O-FLAG.  WRITE TAPOT-REC.          C2631
25040      MOVE TRK-OT-1 (4) TO TAPOT-REC.                 C2631
25050      MOVE  4   TO O-FLAG.  WRITE TAPOT-REC.          C2631
25060  BYPASS-CALIBRATION.                                 C2631
25070      READ TAPIN INTO BYTES-1-40  AT END STOP RUN.    C2631
25080      READ TAPIN INTO BYTES-41-80 AT END STOP RUN.    C2631
25090      IF TRK-CD-TYP = ' 4'          AND
               (TRK-VC1 = '-' OR
```

9 - MODE PROFILE (cont'd)

```
             TRK-VC2 LESS THAN 200)
                 MOVE 'L' TC VC-SWITCH.
25090      IF TRK-CD-TYP = ' 4'                                            C2631
25100          COMPLTE AMBIENT-PLUS-FIFTY = TRK-AMBIENT + 50.              C2631
25110      IF TRK-CD-TYP = 'GR'                                            C2631
25120          COMPLTE GEAR-RATIC (TRK-GEAR) =                             C2631
25130              TRK-RV1 + TRK-RV2.                                      C2631
25140      IF BYTES-1-40 NOT = '*' GC TC BYFASS-CALIBRATICN.               C2631
25150  HDR-EXIT.          EXIT.                                           C2631
25160                                                                      C2631
25170                                                                      C2631
25180  WRITE-SPCCL SECTION.                                                C2631
25190      MCVE PRT TC SPOOL-CUT.                                          C2631
25200      MOVE C-CTL TC SPOOL-CC.                                         C2631
25210      WRITE PRT AFTER C-CTL.                                          C2631
25220      WRITE SPGOL-OUT.                                                C2631
25230  WRITE-SPOCL-EXIT.                                                   C2631
25240      EXIT.                                                           C2631
```

9 - MODE PROFILE (cont'd)

```
// EXEC ASSEMBLY                                                             SUPRS
         ICTL 1,71,21                                                        SUPRS
C1C1OSUPP        TITLE 'SUPRESS CANCELLATICN DUE TC PROGRAM CHECK   ABC'     SUPRS
     SLPRS START C                                                           SUPRS
C1C2C            LSING *,15                                                  SUPRS
01C32COMRG       CCMRG                                                       SUPRS
01C34            TM   23(1),2                                                SUPRS
01C36            BC   RETLRN                                                 SUPRS
C1C40            STXIT PC,DUMP,SAVF                                          SUPRS
                 CLC  1C(2,14),SVC1C                                         SUPRS
                 BNE  RETLRN                                                 SUPRS
                 MVC  10(2,14),NOP                                           SUPRS
                 EX   0,0(0,14)                                              SUPRS
                 L    1,=A(SAVFRET)                                          SUPRS
                 ST   0,C(1)                                                 SUPRS
01C50RETURN      BR   14                                                     SUPRS
C106C            LTCRG                                                       SUPRS
01C80SAVE        DS   9D                                                     SUPRS
      NOP        CC   X'C700'                                                SUPRS
      SVC1C      CC   X'0A10'                                                SUPRS
C1C65            DROP 15                                                     SUPRS
C1C7CDLMP        BALR 15,0                                                   SUPRS
                 LSING *,15                                                  SUPRS
                 CLC  SAVERET,=F'0'                                          SUPRS
                 BNE  COBCL                                                  SUPRS
      ASSEM      L    1,=A(SAVE)                                             SUPRS
                 LNPK PSW(9),0(5,1)                                          SUPRS
                 LNPK PSW+8(9),4(5,1)                                        SUPRS
                 NC   PSW,=16X'CF'                                           SUPRS
                 TR   PSW(16),TAB                                            SUPRS
                 MVI  CCW,11                                                 SUPRS
                 EXCP CCB                                                    SUPRS
                 WAIT CCB                                                    SUPRS
                 MVI  CCW,9                                                  SUPRS
                 EXCP CCB                                                    SUPRS
                 WAIT CCB                                                    SUPRS
                 LH   1,CNTR                                                 SUPRS
                 BCT  1,*+6                                                  SUPRS
                 SVC  14                                                     SUPRS
                 STH  1,CNTR                                                 SUPRS
                 EXIT PC                                                     SUPRS
      COBOL      L    2,=A(SAVE)                                             SUPRS
                 CLI  3(2),8                                                 SUPRS
                 BL   ASSEM                                                  SUPRS
                 L    1,SAVERET                                              SUPRS
                 MVC  12(72,1),C(2)                                          SUPRS
                 BR   1                                                      SUPRS
01C55CNTR        DC   H'50'                                                  SUPRS
      TAB        DC   C'0123456789ABCDEF'                                    SUPRS
      MES        DC   C'PC PSW = '                                           SUPRS
      PSW        DS   CL17                                                   SUPRS
      CCW        CCW  9,MFS,0,25                                             SUPRS
      CCB        CCB  SYSLST,CCW                                             SUPRS
      SAVERET    DC   F'C'                                                   SUPRS
C110C            END
```

9 - MODE PROFILE (cont'd)

```
// EXEC ASSEMBLY
         ICTL 6,71,21
01010NOTP      TITLE 'SUPPRESS TAPEMARK ON FRONT OF COBOL OUTPUT ABC'
01020NOTPMK    START 0
01030          USING *,15
01060          ST   1,0(13)
01070          LA   1,CCW
01080          ST   1,4(13)
01090          MVC  CCB+9(3),5(13)
01095          L    1,0(13)
01100          L    1,0(1)
01110          LH   1,0(1)
01120          STC  1,CCB+7
01130          LA   1,CCB
01140          EXCP (1)
01150          WAIT (1)
01160          BR   14
01170CCW       CCW  47,*,0,1
01180CCB       CCB  SYS000,CCW
01190          END
```

10 - PRINT MODE SUMMARY TABLE

```
PT. HCVWZVSC11
// EXEC COBOL
01010  IDENTIFICATION DIVISION.
01020  PROGRAM-ID. 'C2643'.                                       C2643
01030  ENVIRONMENT DIVISION.                                      C2643
01040  INPUT-OUTPUT SECTION.                                      C2643
01050  FILE-CONTROL.                                              C2643
01060      SELECT TAPIN ASSIGN 'SYS012' UTILITY 2400.             C2643
01070      SELECT PRT ASSIGN 'SYS009' UNIT-RECORD 1403.           C2643
01080  DATA DIVISION.                                             C2643
01090  FILE SECTION.                                              C2643
01100                                                             C2643
01110  FD  TAPIN                                                  C2643
01120          RECORDING MODE F.                                  C2643
01130          LABEL RECORDS OMITTED.                             C2643
01140          RECORD CONTAINS  20 CHARACTERS.                    C2643
01150          BLOCK CONTAINS 181 RECORDS.                        C2643
01160          DATA RECORD TAPIN-REC.                             C2643
01170  01  TAPIN-REC.                                             C2643
01180      07  T-MODE-IMAGE.                                      C2643
01190          14  T-FMODE   PICTURE S9V99.                       C2643
01200          14  T-FMODE9X REDEFINES T-FMODE.                   C2643
01210              21  T-FMODE9   PICTURE S99.                    C2643
01220              21  T-FSUB     PICTURE S99.                    C2643
01230          14  T-TMODE   PICTURE S9V99.                       C2643
01240          14  T-TMODE9  REDEFINES T-TMODE  PICTURE S99.      C2643
01250      07  T-TIME         PICTURE S9(7)V99, COMPUTATIONAL-3.  C2643
01260      07  T-FREQ   PICTURE S9(5)  COMPUTATIONAL-3.           C2643
01270      07  FILLER   PICTURE XX.                               C2643
01280      07  T-FLAGS         PICTURE X.                         C2643
01290      07  T-FLAG   PICTURE X.                                C2643
01300  FD  PRTF                                                   C2643
01310          RECORDING MODE F, LABEL RECORDS OMITTED,           C2643
01320          DATA RECORD PRT.                                   C2643
01330  01  PRT.                                                   C2643
01340      07  FILLER   PICTURE X.                                C2643
01350      07  PRT1      PICTURE X(81).                           C2643
01360      07  PRT2     PICTURE X(51).                            C2643
01370                                                             C2643
01380                                                             C2643
01390  WORKING-STORAGE SECTION.                                   C2643
01400                                                             C2643
01405      77  STAND-ALONE         PICTURE X, VALUE SPACE.        C2643
01407
01410  01  HOLD-AREAS.
01420      07  H-FMODE  PICTURE 99V99.                            C2643
01430      07  H-FMODE9  REDEFINES H-FMODE  PICTURE S99.          C2643
01440      07  H-TMODE  PICTURE 99V99.                            C2643
01450      07  H-TMODES  REDEFINES H-FMODE  PICTURE S99.          C2643
01460                                                             C2643
01470  01  COMP-TAB  COMPUTATIONAL.                               C2643
01480      07  X1   PICTURE S999.                                 C2643
01490      07  X2   PICTURE S999.                                 C2643
01500                                                             C2643
02010  01  COMP-3-TAB   COMPUTATIONAL-3.                          C2643
02020      07  LINCNT          PICTURE S999 VALUE 900.            C2643
                                                                  C2643
```

```
02030      07  WX        PICTURE S9(7)V99.
02040      07  W1        PICTURE S9(7).                           C2643
02050      07  W2        PICTURE S9(7).                           C2643
02060      07  W-TIME    PICTURE S9(7)V99.                        C2643
02070      07  W-FREQ    PICTURE S9(7).                           C2643
02080      07  TM-FREQ   PICTURE S9(7).                           C2643
02090      07  TS-FREQ   PICTURE S9(7).                           C2643
02100      07  TS-TIME   PICTURE S9(7)V99.                        C2643
02110      07  W-DIF     PICTURE S9(7)V99.                        C2643
02120      07  W-DAYS    PICTURE S9, VALUE 1.                     C2643
02130                                                             C2643
02140  01  HD1.                                                   C2643
02150      07  FILLER         PICTURE X.                          C2643
02160      07  FILLER         PICTURE X(16) VALUE 'EPA TRUCK STUDY'.  C2643
02170      07  FILLER         PICTURE X(08) VALUE '120210  '.     C2643
02180      07  FILLER         PICTURE X(16) VALUE SPACE.          C2643
02190      07  HD1-DATE       PICTURE X(51) VALUE SPACE.          C2643
02200      07  FILLER         PICTURE X(5)  VALUE 'PAGE '.        C2643
02210      07  HD1-PAGE       PICTURE 9(4), VALUE ZERO.           C2643
02220                                                             C2643
02230  01  HD3.                                                   C2643
02240      07  FILLER         PICTURE X(7)  VALUE ' TRUCK='.      C2643
02250      07  HD3-TRK-ID     PICTURE XX.                         C2643
02260      07  FILLER         PICTURE X(7)  VALUE '  CITY='.      C2643
02270      07  HD3-CITY       PICTURE X(4).                       C2643
02280      07  FILLER         PICTURE X(13) VALUE '  TYPE TRUCK='.  C2643
02290      07  HD3-TYP        PICTURE X.                          C2643
02300      07  FILLER         PICTURE X(12) VALUE '  FUEL TYPE='.  C2643
02310      07  HD3-FUEL       PICTURE X(6).                       C2643
02320      07  FILLER         PICTURE X(9)  VALUE '  WEIGHT='.    C2643
02330      07  HD3-WT         PICTURE XX.                         C2643
02340      07  FILLER         PICTURE X(10) VALUE '  LICENSE='.   C2643
02350      07  HD3-LICENSE    PICTURE X(8).                       C2643
02360      07  FILLER         PICTURE X(11) VALUE '  INDUSTRY='.  C2643
02370      07  HD3-IND        PICTURE XX.                         C2643
02380                                                             C2643
02390  01  HD4.                                                   C2643
02400      07  FILLER         PICTURE X(14) VALUE ' ENGINE MODEL='.  C2643
02410      07  HD4-ENGINE     PICTURE X(10).                      C2643
02420      07  FILLER         PICTURE X(16) VALUE '  SERIAL NUMBER='.  C2643
02430      07  HD4-SERIAL     PICTURE X(20).                      C2643
02440      07  FILLER         PICTURE X(15) VALUE '  DAYS SAMPLED='.  C2643
02450      07  HD4-NDAYS      PICTURE X.                          C2643
02460      07  DAY-FIELD.                                         C2643
02470          14  HD4-MDAY  PICTURE X(16) VALUE SPACE.           C2643
02480          14  HD4-CDAYS PICTURE X, VALUE SPACE.              C2643
02490          14  HD4-CDAYS1      PICTURE X(8)  VALUE SPACE.     C2643
02500      07  DAY-FIELD1 REDEFINES DAY-FIELD.                    C2643
03010          14  HD4-SDAY  PICTURE X(6).                        C2643
03020          14  HD4-DAY   PICTURE X.                           C2643
03030                                                             C2643
03040  01  HD5.                                                   C2643
03050      07  FILLER   PICTURE X(39) VALUE SPACE.                C2643
03060      07  FILLER   PICTURE X(17) VALUE '--- MEAN TIME ---'.  C2643
03070      07  FILLER   PICTURE X(14) VALUE '    VARIANCE  '.     C2643
03080      07  FILLER   PICTURE X(9)  VALUE 'DEVIATION'.          C2643
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10 - PRINT MODE SUMMARY (cont'd)

```
03090      07  FILLER    PICTURE X(3)  VALUE SPACE.                    C2643
03100      07  FILLER    PICTURE X(10) VALUE 'TRANSITION'.             C2643
03110                                                                  C2643
03120  01  MD6.                                                        C2643
03130      07  FILLER    PICTURE X(5)  VALUE SPACE.                    C2643
03140      07  FILLER    PICTURE X(4)  VALUE 'MODE'.                   C2643
03150      07  FILLER    PICTURE X(10) VALUE SPACE.                    C2643
03160      07  FILLER    PICTURE X(09) VALUE 'FREQUENCY'.              C2643
03170      07  FILLER    PICTURE X(3)  VALUE SPACE.                    C2643
03180      07  FILLER    PICTURE X(17) VALUE 'SECONDS  HH.MM.SS'.      C2643
03190      07  FILLER    PICTURE X(4)  VALUE SPACE.                    C2643
03200      07  FILLER    PICTURE X(8)  VALUE 'SECONDS '.               C2643
03210      07  FILLER    PICTURE X(3)  VALUE SPACE.                    C2643
03220      07  FILLER    PICTURE X(8)  VALUE 'HH.MM.SS'.               C2643
03230      07  FILLER    PICTURE X(3)  VALUE SPACE.                    C2643
03240      07  FILLER    PICTURE X(11) VALUE 'PROBABILITY'.            C2643
03250                                                                  C2643
03260  01  MD7.                                                        C2643
03270      07  FILLER    PICTURE X(20) VALUE SPACE.                    C2643
03280      07  FILLER    PICTURE X(4)  VALUE '1.00'.                   C2643
03290      07  FILLER    PICTURE X(6)  VALUE SPACE.                    C2643
03300      07  FILLER    PICTURE X(4)  VALUE '2.00'.                   C2643
03310      07  FILLER    PICTURE X(06) VALUE SPACE.                    C2643
03320      07  FILLER    PICTURE X(4)  VALUE '3.00'.                   C2643
03330      07  FILLER    PICTURE X(6)  VALUE SPACE.                    C2643
03340      07  FILLER    PICTURE X(4)  VALUE '4.00'.                   C2643
03350      07  FILLER    PICTURE X(6)  VALUE SPACE.                    C2643
03360      07  FILLER    PICTURE X(4)  VALUE '5.00'.                   C2643
03370      07  FILLER    PICTURE X(06) VALUE SPACE.                    C2643
03380      07  FILLER    PICTURE X(4)  VALUE '6.00'.                   C2643
03390      07  FILLER    PICTURE X(06) VALUE SPACE.                    C2643
03400      07  FILLER    PICTURE X(4)  VALUE '7.00'.                   C2643
03410      07  FILLER    PICTURE X(06) VALUE SPACE.                    C2643
03420      07  FILLER    PICTURE X(4)  VALUE '8.00'.                   C2643
03430      07  FILLER    PICTURE X(06) VALUE SPACE.                    C2643
03440      07  FILLER    PICTURE X(4)  VALUE '9.00'.                   C2643
03450      07  FILLER    PICTURE X(05) VALUE SPACE.                    C2643
03460      07  FILLER    PICTURE X(5)  VALUE '10.00'.                  C2643
03470                                                                  C2643
03480  01  MD8.                                                        C2643
03490      07  MD81.                                                   C2643
03500          14  FILLER    PICTURE X(16) VALUE ' MODE FREQUENCY '.   C2643
04010          14  FILLER    PICTURE X(06) VALUE 'MATRIX'.             C2643
04020      07  MD82.                                                   C2643
04030          14  FILLER    PICTURE X(19) VALUE ' MEAN TIME IN MODE '. C2643
04040          14  FILLER    PICTURE X(6)  VALUE 'MATRIX'.             C2643
04050      07  MD82-1.                                                 C2643
04060          14  FILLER    PICTURE X(8) VALUE ' TIME IN'.            C2643
04070          14  FILLER    PICTURE X(14) VALUE ' HOURS.MINUTES'.     C2643
04080          14  FILLER    PICTURE X(08) VALUE '.SECONDS'.           C2643
04090      07  MD83.                                                   C2643
04100          14  FILLER    PICTURE X(16) VALUE ' VARIANCE MATRIX'.   C2643
04110      07  MD84.                                                   C2643
04120          14  FILLER    PICTURE X(16) VALUE ' TRANSITION PROB'.   C2643
04130          14  FILLER    PICTURE X(14) VALUE 'ABILITY MATRIX'.     C2643
04140      07  MD85.                                                   C2643
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04150          14  FILLER    PICTURE X(19) VALUE ' CRUISE MODE MATRIX'.   C2643
04160      07  MD86.                                                      C2643
04170          14  FILLER    PICTURE X(17) VALUE ' INTENSITY MATRIX'.     C2643
04180      07  MD87.                                                      C2643
04190          14  FILLER    PICTURE X(19) VALUE ' ESTIMATED DISTANCE'.   C2643
04200          14  FILLER    PICTURE X(16) VALUE ' TRAVELED MATRIX'.      C2643
04210      07  MD88.                                                      C2643
04220          14  FILLER    PICTURE X(19) VALUE ' TRAFFIC CONDITION '.   C2643
04230          14  FILLER    PICTURE X(6)  VALUE 'MATRIX'.                C2643
04240      07  MD88-1.                                                    C2643
04250          14  FILLER    PICTURE X(5)  VALUE SPACE.                   C2643
04260          14  FILLER    PICTURE X(16) VALUE 'PERCENT OF TIME '.      C2643
04270          14  FILLER    PICTURE X(8)  VALUE 'TRUCK IN'.              C2643
04280      07  MD89.                                                      C2643
04290          14  FILLER    PICTURE X(16) VALUE ' SUM HORSEPOWER '.      C2643
04300          14  FILLER    PICTURE X(06) VALUE 'MATRIX'.                C2643
04310      07  MD90.                                                      C2643
04320          14  FILLER    PICTURE X(18) VALUE ' DECELERATE MODES '.    C2643
04330          14  FILLER    PICTURE X(18) VALUE 'TIME VALVE CLOSED '.    C2643
04340          14  FILLER    PICTURE X(13) VALUE '(HH.MM.SS) = '.         C2643
04350          14  MD90-1    PICTURE X(8).                                C2643
04360      07  MD91.                                                      C2643
04370          14  FILLER    PICTURE X(17) VALUE ' VARIANCE IN TIME'.     C2643
04380          14  FILLER    PICTURE X(11) VALUE ' AMONG DAYS'.           C2643
           07  MD92.
               14  FILLER  PICTURE X(19) VALUE ' VEHICLE OPERATING '.
               14  FILLER  PICTURE X(11) VALUE 'TIME MATRIX'.
04390                                                                     C2643
       01  MD-OPERATING-TIME.
           07  MD-TIME.
               14  FILLER    PICTURE X(3) VALUE SPACE.
               14  FILLER    PICTURE X(4) VALUE 'MODE'.
               14  FILLER    PICTURE X(7) VALUE SPACE.
               14  FILLER    PICTURE X(4) VALUE 'TIME'.
           07  OP-TIME-REC.
               14  FILLER    PICTURE XX VALUE SPACE.
               14  OP-MODE   PICTURE X(8).
               14  FILLER    PICTURE XX VALUE SPACE.
               14  OP-HMS    PICTURE X(8).

04400  01  MD9.                                                           C2643
04410      07  FILLER        PICTURE X(20) VALUE SPACE.                   C2643
04420      07  FILLER        PICTURE X(4)  VALUE 'IDLE'.                  C2643
04430      07  FILLER        PICTURE X(6)  VALUE SPACE.                   C2643
04440      07  FILLER        PICTURE X(4)  VALUE 'STOP'.                  C2643
04450      07  FILLER        PICTURE X(6)  VALUE SPACE.                   C2643
04460      07  FILLER        PICTURE X(4)  VALUE 'SOAK'.                  C2643
04470      07  FILLER        PICTURE X(4)  VALUE SPACE.                   C2643
04480      07  FILLER        PICTURE X(6)  VALUE 'CRUISE'.                C2643
04490      07  FILLER        PICTURE X(7)  VALUE SPACE.                   C2643
04500      07  FILLER        PICTURE X(03)  VALUE 'ACC'.                  C2643
05010      07  FILLER        PICTURE X(2)  VALUE SPACE.                   C2643
05020      07  FILLER        PICTURE X(8)  VALUE 'ACC-GEAR'.              C2643
05030      07  FILLER   PICTURE       X(3)  VALUE SPACE.                  C2643
05040      07  FILLER   PICTURE       X(07) VALUE  'DEC-DYN'.             C2643
05050      07  FILLER   PICTURE       X(3)  VALUE SPACE.                  C2643
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10 - PRINT MODE SUMMARY (cont'd)

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05060      07  FILLER   PICTURE       X(07) VALUE  'CEC-PWR'.          C2643
05070      07  FILLER   PICTURE       X(3)  VALUE SPACE.               C2643
05080      07  FILLER   PICTURE       X(07) VALUE  'CEC-THC'.          C2643
05090      07  FILLER   PICTURE       X(5)  VALUE SPACE.               C2643
05100      07  FILLER         PICTURE X(05)  VALUE 'COAST'.            C2643
05110                                                                  C2643
05120  01  DET.                                                        C2643
05130      07  FILLER         PICTURE X(5)  VALUE SPACE.               C2643
05140      07  D-MODET1       PICTURE Z9.99.                           C2643
05150      07  FILLER   PICTURE X, VALUE '-'.                          C2643
05160      07  D-MODET2       PICTURE X(14).                           C2643
05170      07  FILLER   PICTURE XX     VALUE SPACE.                    C2643
05180      07  D-FREQ   PICTURE Z,ZZZ,ZZZ.                             C2643
05190      07  D-TIME   PICTURE ZZZ,ZZZ.99.                            C2643
05200      07  FILLER   PICTURE X(2)   VALUE SPACE.                    C2643
05210      07  D-TIME-HMS     PICTURE X(8).                            C2643
05220      07  FILLER   PICTURE X      VALUE SPACE.                    C2643
05230      07  D-VARIANCE     PICTURE ZZZ,ZZZ.999.                     C2643
05240      07  D-VARX  REDEFINES D-VARIANCE  PICTURE X(11).            C2643
05250      07  FILLER   PICTURE X(3)   VALUE SPACE.                    C2643
05260      07  D-DEV-HMS      PICTURE X(8).                            C2643
05270      07  FILLER   PICTURE X(5) VALUE SPACE.                      C2643
05280      07  D-TRANS  PICTURE ZZ,ZZZ.99.                             C2643
05290                                                                  C2643
05300  01  DET-1.                                                      C2643
05310      07  FILLER         PICTURE X.                               C2643
05320      07  F-MODEF1       PICTURE Z9.99.                           C2643
05330      07  FILLER   PICTURE X, VALUE '-'.                          C2643
05340      07  F-MODEF2       PICTURE X(14).                           C2643
05350                                                                  C2643
05360  01  DET-2.                                                      C2643
05370      07  FILLER         PICTURE X.                               C2643
05380      07  L-MODE         PICTURE Z9.                              C2643
05390      07  FILLER         PICTURE X(4)  VALUE '.00-'.              C2643
05400      07  L-MODED        PICTURE X(14).                           C2643
05410      07  FILLER         PICTURE X     VALUE SPACE.               C2643
05420      07  L-COM          PICTURE X(109).                          C2643
05430      07  L-COM1         REDEFINES L-COM.                         C2643
05440          14  L-COM2     OCCURS 10 TIMES.                         C2643
05450              21  L-P2         PICTURE Z(9)9.                     C2643
05460      07  L-COM3         REDEFINES L-COM.                         C2643
05470          14  L-COM4     OCCURS 10 TIMES.                         C2643
05480              21  L-P2         PICTURE   ZZZ,ZZZ.99.              C2643
05490      07  L-COM5         REDEFINES L-COM.                         C2643
05500          14  L-COM6     OCCURS 10 TIMES.                         C2643
06010              21  L-P3         PICTURE   ZZ,ZZZ.999.              C2643
06020      07  L-COM7         REDEFINES L-COM.                         C2643
06030          14  L-COM8     OCCURS 10 TIMES.                         C2643
06040              21  L-PC         PICTURE X(10).                     C2643
06050                                                                  C2643
06060  01  HC-CM.                                                      C2643
06070      07  HD-CM1.                                                 C2643
06080          14  FILLER     PICTURE X(4) VALUE SPACE.                C2643
06090          14  FILLER     PICTURE X(11) VALUE '-- SPEED --'.       C2643
06100          14  FILLER     PICTURE X(17) VALUE SPACE.               C2643
06110          14  FILLER     PICTURE X(7)  VALUE 'AVERAGE'.           C2643
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06120      07  HD-CM2.                                                 C2643
06130          14  FILLER     PICTURE X(4)  VALUE SPACE.               C2643
06140          14  FILLER     PICTURE X(11) VALUE 'FROM    TO'.        C2643
06150          14  FILLER     PICTURE X(3)  VALUE SPACE.               C2643
06160          14  FILLER     PICTURE X(9)  VALUE 'FREQUENCY'.         C2643
06170          14  FILLER     PICTURE X(5)  VALUE SPACE.               C2643
06180          14  FILLER     PICTURE X(8)  VALUE 'HH.MM.SS'.          C2643
06190      07  HD-CM3.                                                 C2643
06200          14  FILLER     PICTURE X(11) VALUE ' 0.0 -  5.0'.       C2643
06210          14  FILLER     PICTURE X(11) VALUE ' 5.1 - 10.0'.       C2643
06220          14  FILLER     PICTURE X(11) VALUE '10.1 - 15.0'.       C2643
06230          14  FILLER     PICTURE X(11) VALUE '15.1 - 20.0'.       C2643
06240          14  FILLER     PICTURE X(11) VALUE '20.1 - 25.0'.       C2643
06250          14  FILLER     PICTURE X(11) VALUE '25.1 - 30.0'.       C2643
06260          14  FILLER     PICTURE X(11) VALUE '30.1 - 35.0'.       C2643
06270          14  FILLER     PICTURE X(11) VALUE '35.1 - 40.0'.       C2643
06280          14  FILLER     PICTURE X(11) VALUE '40.1 - 45.0'.       C2643
06290          14  FILLER     PICTURE X(11) VALUE '45.1 - 50.0'.       C2643
06300          14  FILLER     PICTURE X(11) VALUE '50.1 - 55.0'.       C2643
06310          14  FILLER     PICTURE X(11) VALUE '55.1 - 60.0'.       C2643
06320          14  FILLER     PICTURE X(11) VALUE '60.1 - 65.0'.       C2643
06330          14  FILLER     PICTURE X(11) VALUE '65.1 - 70.0'.       C2643
06340          14  FILLER     PICTURE X(11) VALUE '70.1 - 75.0'.       C2643
06350          14  FILLER     PICTURE X(11) VALUE '75.1 - 80.0'.       C2643
06360          14  FILLER     PICTURE X(11) VALUE '80.1 - UP  '.       C2643
06370      07  HD-CM4   REDEFINES HD-CM3.                              C2643
06380          14  HD-CM5     PICTURE X(11)  OCCURS 17 TIMES.          C2643
06390      07  CM-DET.                                                 C2643
06400          14  FILLER     PICTURE X(4) VALUE SPACE.                C2643
06410          14  CM-SPEED   PICTURE X(11).                           C2643
06420          14  FILLER     PICTURE X(3)  VALUE SPACE.               C2643
06430          14  CM-FREQ    PICTURE Z,ZZZ,ZZ9.                       C2643
06440          14  FILLER     PICTURE XXX VALUE SPACES.                C2643
06450          14  CM-TIME    PICTURE X(12).                           C2643
06460  01  HC-INT.                                                     C2643
06470      07  HD-INT1.                                                C2643
06480          14  FILLER     PICTURE X(18) VALUE SPACE.               C2643
06490          14  FILLER     PICTURE X(18) VALUE '---- ACCELERATION '. C2643
06500          14  FILLER     PICTURE X(4)  VALUE '----'.              C2643
07010          14  FILLER     PICTURE X(5)  VALUE SPACE.               C2643
07020          14  FILLER     PICTURE X(19) VALUE '----- CEC-DYNAMIC -'. C2643
07030          14  FILLER     PICTURE X(3) VALUE '---'.                C2643
07040          14  FILLER     PICTURE X(5)  VALUE SPACE.               C2643
07050          14  FILLER     PICTURE X(19) VALUE '------ CEC-POWER --'. C2643
07060          14  FILLER     PICTURE X(3) VALUE '---'.                C2643
07070          14  FILLER     PICTURE X(5)  VALUE SPACE.               C2643
07080          14  FILLER     PICTURE X(20) VALUE ' CEC-THROTTLE CLOSED'. C2643
07090      07  HD-INT2.                                                C2643
07100          14  FILLER     PICTURE X(5)  VALUE SPACE.               C2643
07110          14  FILLER     PICTURE X(9)  VALUE 'INTENSITY'.         C2643
07120          14  FILLER     PICTURE X(18) VALUE SPACE.               C2643
07130          14  FILLER     PICTURE X(7) VALUE 'AVERAGE'.            C2643
07140          14  FILLER     PICTURE X(20) VALUE SPACE.               C2643
07150          14  FILLER     PICTURE X(7)  VALUE 'AVERAGE'.           C2643
07160          14  FILLER     PICTURE X(20) VALUE SPACE.               C2643
07170          14  FILLER     PICTURE X(7)  VALUE 'AVERAGE'.           C2643
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10 - PRINT MODE SUMMARY (cont'd)

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07180          14  FILLER      PICTURE X(20) VALUE SPACE.                    C2043
07190          14  FILLER      PICTURE X(7)  VALUE 'AVERAGE'.                C2043
07200      07  MD-INT3.                                                      C2043
07210          14  FILLER      PICTURE X(4)  VALUE SPACE.                    C2043
07220          14  FILLER      PICTURE X(11) VALUE 'FROM      TO'.           C2043
07230          14  FILLER      PICTURE X(12) VALUE '   FREQUENCY'.           C2043
07240          14  FILLER      PICTURE X(13) VALUE '     HH.MM.SS'.          C2043
07250          14  FILLER      PICTURE X(5)  VALUE SPACE.                    C2043
07260          14  FILLER      PICTURE X(9)  VALUE 'FREQUENCY'.              C2043
07270          14  FILLER      PICTURE X(13) VALUE '     HH.MM.SS'.          C2043
07280          14  FILLER      PICTURE X(5)  VALUE SPACE.                    C2043
07290          14  FILLER      PICTURE X(9)  VALUE 'FREQUENCY'.              C2043
07300          14  FILLER      PICTURE X(13) VALUE '     HH.MM.SS'.          C2043
07310          14  FILLER      PICTURE X(5)  VALUE SPACE.                    C2043
07320          14  FILLER      PICTURE X(9)  VALUE 'FREQUENCY'.              C2043
07330          14  FILLER      PICTURE X(13) VALUE '     HH.MM.SS'.          C2043
07340      07  MD-DET.                                                       C2043
07350          14  FILLER      PICTURE X(4)  VALUE SPACE.                    C2043
07360          14  INT-SPEED   PICTURE X(11).                                C2043
07370          14  FILLER      PICTURE X(3)  VALUE SPACE.                    C2043
07380          14  INT-AFREQ   PICTURE Z,ZZZ,ZZ9.                            C2043
07390          14  FILLER      PICTURE XXX VALUE SPACE.                      C2043
07400          14  INT-ATIME   PICTURE X(12).                                C2043
07410          14  FILLER      PICTURE XXX   VALUE SPACE.                    C2043
07420          14  INT-OFREQ   PICTURE Z,ZZZ,ZZ9.                            C2043
07430          14  FILLER      PICTURE XXX VALUE SPACE.                      C2043
07440          14  INT-DTIMD   PICTURE X(12).                                C2043
07450          14  FILLER      PICTURE XXX   VALUE SPACE.                    C2043
07460          14  INT-CFREP   PICTURE Z,ZZZ,ZZ9.                            C2043
07470          14  FILLER      PICTURE XXX VALUE SPACE.                      C2043
07480          14  INT-DTIMP   PICTURE X(12).                                C2043
07490          14  INT-DFREQ   PICTURE Z,ZZZ,ZZ9.                            C2043
07500          14  FILLER      PICTURE XXX   VALUE SPACE.                    C2043
08010          14  FILLER      PICTURE XXX VALUE SPACE.                      C2043
08020          14  INT-DTIME   PICTURE X(12).                                C2043
08030      07  MD-INT4.                                                      C2043
08040          14  FILLER      PICTURE X(11) VALUE ' 0.0 -  0.5'.            C2043
08050          14  FILLER      PICTURE X(11) VALUE ' 0.6 -  1.0'.            C2043
08060          14  FILLER      PICTURE X(11) VALUE ' 1.1 -  1.5'.            C2043
08070          14  FILLER      PICTURE X(11) VALUE ' 1.6 -  2.0'.            C2043
08080          14  FILLER      PICTURE X(11) VALUE ' 2.1 -  2.5'.            C2043
08090          14  FILLER      PICTURE X(11) VALUE ' 2.6 -  3.0'.            C2043
08100          14  FILLER      PICTURE X(11) VALUE ' 3.1 -  3.5'.            C2043
08110          14  FILLER      PICTURE X(11) VALUE ' 3.6 -  4.0'.            C2043
08120          14  FILLER      PICTURE X(11) VALUE ' 4.1 -  5.0'.            C2043
08130          14  FILLER      PICTURE X(11) VALUE ' 5.1 -  6.0'.            C2043
08140          14  FILLER      PICTURE X(11) VALUE ' 6.1 -  7.0'.            C2043
08150          14  FILLER      PICTURE X(11) VALUE ' 7.1 -  8.0'.            C2043
08160          14  FILLER      PICTURE X(11) VALUE ' 8.1 -  9.0'.            C2043
08170          14  FILLER      PICTURE X(11) VALUE ' 9.1 - 10.0'.            C2043
08180          14  FILLER      PICTURE X(11) VALUE '10.1 - 11.0'.            C2043
08190          14  FILLER      PICTURE X(11) VALUE '11.1 - 12.0'.            C2043
08200          14  FILLER      PICTURE X(11) VALUE '12.1 - 15.0'.            C2043
08210          14  FILLER      PICTURE X(11) VALUE '15.1 - 20.0'.            C2043
08220          14  FILLER      PICTURE X(11) VALUE '20.1 - UP  '.            C2043
08230      07  MD-INT5  REDEFINES  MD-INT4.                                  C2043

08240          14  MD-INT6     PICTURE X(11)  OCCURS 19 TIMES.               C2043
08250                                                                        C2043
08260  01  MC-RT.                                                            C2043
08270      07  MD-RT1.                                                       C2043
08280          14  FILLER      PICTURE X(20) VALUE SPACE.                    C2043
08290          14  FILLER      PICTURE X(18) VALUE '---- ARTERIAL ----'.     C2043
08300          14  FILLER      PICTURE X(9)  VALUE SPACE.                    C2043
08310          14  FILLER      PICTURE X(18) VALUE '---- FREEWAY -----'.     C2043
08320          14  FILLER      PICTURE X(9)  VALUE SPACE.                    C2043
08330          14  FILLER      PICTURE X(18) VALUE '------ LOCAL -----'.     C2043
08340          14  FILLER      PICTURE X(9)  VALUE SPACE.                    C2043
08350          14  FILLER      PICTURE X(18) VALUE '---- UNKNOWN -----'.     C2043
08360      07  MD-RT2.                                                       C2043
08370          14  FILLER      PICTURE X(5)  VALUE SPACE.                    C2043
08380          14  FILLER      PICTURE X(4)  VALUE 'MODE'.                   C2043
08390          14  FILLER      PICTURE X(22) VALUE SPACE.                    C2043
08400          14  FILLER      PICTURE X(15) VALUE 'MILES      TIME'.        C2043
08410          14  FILLER      PICTURE X(12) VALUE SPACE.                    C2043
08420          14  FILLER      PICTURE X(15) VALUE 'MILES      TIME'.        C2043
08430          14  FILLER      PICTURE X(12) VALUE SPACE.                    C2043
08440          14  FILLER      PICTURE X(15) VALUE 'MILES      TIME'.        C2043
08450          14  FILLER      PICTURE X(12) VALUE SPACE.                    C2043
08460          14  FILLER      PICTURE X(15) VALUE 'MILES      TIME'.        C2043
08470      07  RT-DT.                                                        C2043
08480          14  FILLER      PICTURE X VALUE SPACE.                        C2043
08490          14  RT-MODEC    PICTURE  Z9.                                  C2043
08500          14  FILLER      PICTURE X(4).                                 C2043
09010          14  RT-MODED    PICTURE X(14).                                C2043
09020          14  FILLER      PICTURE XXX.                                  C2043
09030          14  RT-MILES-TIME  OCCURS 4 TIMES.                            C2043
09040              21  RD-MILES    PICTURE Z,ZZZ,ZZZ.99.                     C2043
09050              21  FILLER      PICTURE XX.                               C2043
09060              21  RD-TIME     PICTURE X(8).                             C2043
09070              21  FILLER      PICTURE X(5).                             C2043
09080                                                                        C2043
09090      07  TC-DT.                                                        C2043
09100          14  FILLER      PICTURE X.                                    C2043
09110          14  TC-TYPE     PICTURE X(7).                                 C2043
09120          14  TD-PCT      PICTURE Z(7).99.                              C2043
09130                                                                        C2043
09140  01  MC-SUM-HORSEPOWER.                                                C2043
09150      07  MD-HP1.                                                       C2043
09160          14  FILLER      PICTURE X(04) VALUE SPACE.                    C2043
09170          14  FILLER      PICTURE X(12) VALUE ALL '-'.                  C2043
09180          14  FILLER      PICTURE X(14) VALUE ' ACCELERATION '.         C2043
09190          14  FILLER      PICTURE X(11) VALUE ALL '-'.                  C2043
09200          14  FILLER      PICTURE X(11) VALUE SPACE.                    C2043
09210          14  FILLER      PICTURE X(14) VALUE ALL '-'.                  C2043
09220          14  FILLER      PICTURE X(08) VALUE ' CRUISE '.               C2043
09230          14  FILLER      PICTURE X(15) VALUE ALL '-'.                  C2043
09240                                                                        C2043
09250      07  MD-HP2.                                                       C2043
09260          14  FILLER      PICTURE X(05) VALUE SPACE.                    C2043
09270          14  FILLER      PICTURE X(09) VALUE 'INTENSITY'.              C2043
09280          14  FILLER      PICTURE X(06) VALUE SPACE.                    C2043
09290          14  FILLER      PICTURE X(06) VALUE 'SUM OF'.                 C2043
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10 - PRINT MODE SUMMARY (cont'd)

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C9300          14  FILLER     PICTURE X(08) VALUE SPACE.                      C2643
C9310          14  FILLER     PICTURE X(07) VALUE 'HP TIME'.                  C2643
C9320          14  FILLER     PICTURE X(11) VALUE SPACE.                      C2643
C9330          14  FILLER     PICTURE X(11) VALUE '-- SPEEC --'.              C2643
C9340          14  FILLER     PICTURE X(05) VALUE SPACE.                      C2643
C9350          14  FILLER     PICTURE X(06) VALUE 'SLM CF'.                   C2643
C9360          14  FILLER     PICTURE X(08) VALUE SPACE.                      C2643
C9370          14  FILLER     PICTURE X(07) VALUE 'HP TIME'.                  C2643
C9380                                                                         C2643
C9390      C7  HD-HP2.                                                        C2643
C9400          14  FILLER     PICTURE X(04) VALUE SPACE.                      C2643
C9410          14  FILLER     PICTURE X(04) VALUE 'FROM'.                     C2643
C9420          14  FILLER     PICTURE X(05) VALUE SPACE.                      C2643
C9430          14  FILLER     PICTURE X(02) VALUE 'TC'.                       C2643
C9440          14  FILLER     PICTURE X(5) VALUE SPACE.                       C2643
C9450          14  FILLER     PICTURE X(10) VALUE 'HCRSEPCWER'.               C2643
C9460          14  FILLER     PICTURE X(03) VALUE SPACE.                      C2643
C9470          14  FILLER     PICTURE X(08) VALUF 'HH.MM.SS'.                 C2643
C9480          14  FILLER     PICTURE X(11) VALUE SPACE.                      C2643
C9490          14  FILLER     PICTURE X(04) VALLE 'FROM'.                     C2643
C9500          14  FILLER     PICTURE X(05) VALUE SPACE.                      C2643
10010          14  FILLER     PICTURE X(02) VALUE 'TC'.                       C2643
10020          14  FILLER     PICTURE X(05) VALUE SPACE.                      C2643
1CC3C          14  FILLER     PICTURE X(10) VALUE 'HCRSEPOWER'.               C2643
1C040          14  FILLER     PICTURE X(03) VALUE SPACE.                      C2643
10050          14  FILLER     PICTURE X(08) VALUE 'HH.MM.SS'.                 C2643
1CC6C                                                                         C2643
1C07C      C7  HP-DET.                                                        C2643
10C8C          14  FILLER     PICTURE X(4).                                   C2643
1CG9C          14  HP-INT     PICTURE X(11).                                  C2643
1010C          14  FILLER     PICTURE X(3).                                   C2643
10110          14  HP-AMP     PICTURE Z,ZZZ,ZZZ.99.                           C2643
10120          14  FILLER     PICTURE X(3).                                   C2643
1013C          14  HP-ATIME   PICTURE X(8).                                   C2643
1C140          14  FILLER     PICTURE X(11).                                  C2643
1C150          14  HP-SPD     PICTURE X(11).                                  C2643
1C16C          14  FILLER     PICTURE X(3).                                   C2643
1C17C          14  HP-CHP     PICTURE Z,ZZZ,ZZZ.99.                           C2643
10180          14  FILLER     PICTURE X(3).                                   C2643
1C19C          14  HP-CTIME   PICTURE X(8).                                   C2643
1C2CC                                                                         C2643
1C21C  C1  SUMMARY-MATRIX.                                                    C2643
1C220      C7  TIME-SC          PICTURE S9(7) VALUE ZERC, CCMPUTATIONAL-3.    C2643
1C230      C7  SUMMARY-MATRIX1  CCCURS 10 TIMES.                              C2643
10240          14  SUMMARY-MATRIX2 CCCURS 10 TIMES.                           C2643
10250              21  SM-FREG      PICTURE S9(7) COMPUTATICNAL-3.            C2643
1C260              21  SM-MEAN      CCMPUTATICNAL-1.                          C2643
1C27C              21  SM-SMSQRS    CCMPUTATIONAL-2.                          C2643
10280              21  TIME-IN-MODE      PICTURE S9(13)V99.                   C2643
1C29C                                    CCMPUTATICNAL-3.                     C2643
1C30C      C7  SUM-PC.  PICTURE S9(7) COMPUTATICNAL-3.                        C2643
1C31C                                                                         C2643
1032C      C7  SUMMARY-MATRIX3  CCMPUTATICNAL-3                               C2643
1C33C                           CCCURS 20 TIMES.                              C2643
1C340          14  CRUISE-FREG     PICTURE S9(7).                             C2643
1C350          14  CRUISE-TIME     PICTURE S9(7)V99.                          C2643
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10360          14  ACC-FREG        PICTURE S9(7).                             C2643
1C37C          14  ACC-TIME        PICTURE S9(7)V99.                          C2643
10380          14  DEC-FREQ        PICTURE S9(7).                             C2643
1C390          14  DEC-TIME        PICTURE S9(7)V99.                          C2643
1C40C          14  DEC-FREC        PICTURE S9(7).                             C2643
10410          14  DEC-TIMD        PICTURE S9(7)V99.                          C2643
10420          14  DEC-FREP        PICTURE S9(7).                             C2643
1C430          14  DEC-TIMP        PICTURE S9(7)V99.                          C2643
1044C          14  ACC-HP     PICTURE S9(7)V99.                               C2643
10450          14  CRUISE-HP PICTURE S9(7)V99.                                C2643
10460                                                                         C2643
10470      C7  SUMMARY-MATRIX4  CCMPUTATICNAL-3  CCCURS 1C TIMES.             C2643
1C480          14  RT-MT.                                                     C2643
10490              21  SUMMARY-MATRIX5  CCCURS 4 TIMES.                       C2643
1C500                  28  RT-MILES     PICTURE S9(7)V99.                     C2643
11C10                  28  RT-TIME      PICTURE S9(5).                        C2643

           C7  SUMMARY-MATRIX4-A  COMPUTATICNAL-3  CCCURS 5 TIMES.
               14  TT-TIME    PICTURE S9(7).
1102C                                                                         C2643
11030      C7  SUMMARY-MATRIX6  CCMPUTATICNAL-3  CCCURS 3 TIMES.              C2643
1104C          14  TC-PCT     PICTURE S9(7)V99.                               C2643
11050      C7  TC-PCT-TCT  PICTURE S9(7)V99  CCMPUTATICNAL-3.                 C2643
11060                                                                         C2643
11070      C7  HMS.                                                           C2643
11080          14  FILLER     PICTURE X(2).                                   C2643
11090          14  HH   PICTURE 99.                                           C2643
11100          14  HPM  PICTURE X.                                            C2643
11110          14  MM   PICTURE 99.                                           C2643
11120          14  MPS  PICTURE X.                                            C2643
11130          14  SS    PICTURE 99.                                          C2643
11140      C7  HMS-SHORT  REDEFINES  HMS.                                     C2643
11150          14  FILLER     PICTURE X(2).                                   C2643
11160          14  HMS-8      PICTURE X(8).                                   C2643
11170                                                                         C2643
11180      C7  DUMMY-1.                                                       C2643
11190          14  DUM-1      PICTURE X(19).                                  C2643
11200          14  FILLER     PICTURE X.                                      C2643
11210                                                                         C2643
11220  01  EIGHTY-BYTES.                                                      C2643
11230      C7  EIGHTY-DUMMY.                                                  C2643
11240          14  BYTES-1-19       PICTURE X(19).                            C2643
11250          14  BYTES-20-38      PICTURE X(19).                            C2643
11260          14  BYTES-39-57      PICTURE X(19).                            C2643
11270          14  BYTES-58-76      PICTURE X(19).                            C2643
11280      C7  TRK-IDENT-FMT REDEFINES EIGHTY-DUMMY.                          C2643
11290          14  M-TRK-ID         PICTURE XX.                               C2643
1130C          14  M-CITY           PICTURE X.                                C2643
11310          14  M-TYP-TRK        PICTURE X.                                C2643
11320          14  M-FUEL           PICTURE X.                                C2643
11330          14  M-WEIGHT         PICTURE XX.                               C2643
11340          14  M-LICENSE        PICTURE X(8).                             C2643
11350          14  M-IND            PICTURE XX.                               C2643
11360          14  M-ENGINE         PICTURE X(10).                            C2643
11370          14  M-SERIAL         PICTURE X(20).                            C2643
11380          14  M-NDAYS          PICTURE X.                                C2643
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10 - PRINT MODE SUMMARY (cont'd)

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11390           14  W-DAY          PICTURE X.                            C2643
11400           14  W-DAYS     PICTURE X(8).                             C2643
11410       07  TRA-IDENT-FMT-1  REDEFINES EIGHTY-DUMMY.                 C2643
11420           14  FILLER     PICTURE X(45).                            C2643
11430           14  W-CNT      PICTURE XX.  OCCURS 4 TIMES.              C2643
11440                                                                    C2643
11450   01  SWITCHES.                                                    C2643
11460       07  FIRST-DATA     PICTURE X, VALUE ZERO.                    C2643
11470       07  F-BREAK  PICTURE X, VALUE SPACE.                         C2643
11480       07  L-BREAK  PICTURE X, VALUE SPACE.                         C2643
11490       07  T-BREAK  PICTURE X, VALUE SPACE.                         C2643
11500                                                                    C2643
12010   01  COMP-UTATIONAL-1   COMPUTATIONAL-1.                          C2643
12020       07  W-MEAN.                                                  C2643
12030   01  COMP-UTATIONAL-2   COMPUTATIONAL-2.                          C2643
12040       07  W-SUMSQRS.                                               C2643
12050       07  W-VAR.                                                   C2643
12060                                                                    C2643
12070   01  W-DSC-1.                                                     C2643
12080       07  W-DSC-2.                                                 C2643
12090           14  FILLER PICTURE X(14) VALUE 'IDLE          '.         C2643
12100           14  FILLER PICTURE X(14) VALUE 'STOP          '.         C2643
12110           14  FILLER PICTURE X(14) VALUE 'HOT-SOAK      '.         C2643
12120           14  FILLER PICTURE X(14) VALUE 'CRUISE        '.         C2643
12130           14  FILLER PICTURE X(14) VALUE 'ACCELERATION  '.         C2643
12140           14  FILLER PICTURE X(14) VALUE 'ACC-GEAR      '.         C2643
12150           14  FILLER PICTURE X(14) VALUE 'DEC-DYNAMIC   '.         C2643
12160           14  FILLER PICTURE X(14) VALUE 'DEC-POWER     '.         C2643
12170           14  FILLER PICTURE X(14) VALUE 'DEC-THRCT-CLSD'.         C2643
12180           14  FILLER PICTURE X(14) VALUE 'COAST         '.         C2643
12190       07  W-DSC-3 REDEFINES W-DSC-2.                               C2643
12200           14  W-DSC  OCCURS 10 TIMES  PICTURE X(14).               C2643

            07  W-DSC-4.
                14  FILLER     PICTURE X(8) VALUE 'IDLE    '.
                14  FILLER     PICTURE X(8) VALUE 'STOP    '.
                14  FILLER     PICTURE X(8) VALUE 'HOT-SOAK'.
                14  FILLER     PICTURE X(8) VALUE 'OTHER   '.
                14  FILLER     PICTURE X(8) VALUE 'TOTAL   '.
            07  W-DSC-5 REDEFINES W-DSC-4.
                14  CP-TIME    PICTURE X(8)  OCCURS 5 TIMES.
12210                                                                    C2643
12220                                                                    C2643
12230   PROCEDURE DIVISION.                                              C2643
12270       OPEN INPUT TAPIN WITH NO REWIND.
                OUTPUT PRTF.                                             C2643
12290       ENTER LINKAGE. CALL 'GETDAT' USING MO1-DATE.                 C2643
12300       ENTER COBOL.                                                 C2643
12310       ENTER LINKAGE. CALL 'SUPRS'. ENTER COBOL.                    C2643
12320       MOVE '   .OO-' TO AT-DT.                                     C2643
12330       MOVE ZERO TO TC-PCT (1), TC-PCT (2), TC-PCT (3).             C2643
            MOVE ZERO TO TT-TIME (1), TT-TIME (2), TT-TIME (3),
                TT-TIME (4), TT-TIME (5).
12340       PERFORM MOVE-HEADER.                                         C2643
12350       MOVE 1 TO X1.                                                C2643
12360       PERFORM CLEAR-SUMMARY 10 TIMES.                              C2643
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12370       MOVE 1 TO X1.                                                C2643
12380       PERFORM CLEAR-M2 20 TIMES.                                   C2643
12390                                                                    C2643
12400   LOAD-TABLES.                                                     C2643
12410       READ TAPIN AT END STOP RUN.                                  C2643
12420       IF T-FLAG = 5                                                C2643
12430           PERFORM LOAD-SUMMARY,                                    C2643
12440           GO TO LOAD-TABLES.                                       C2643
12450       IF T-FLAG = 6                                                C2643
12460           PERFORM LOAD-INTENSITY,                                  C2643
12470           GO TO LOAD-TABLES.                                       C2643
12480       IF T-FLAG = 7                                                C2643
12490           PERFORM LOAD-ROAD-TYPE,                                  C2643
12500           GO TO LOAD-TABLES.                                       C2643
13010       GO TO FIRST-TIME-SWITCH.                                     C2643
13020   READ-LOOP.                                                       C2643
13030       READ TAPIN AT END GO TO END-FILE.                            C2643
13040   FIRST-TIME-SWITCH.                                               C2643
13050       GO TO FIRST-TIME.                                            C2643
13060   OTHER-THAN-FIRST-TIME.                                           C2643
13070       IF T-FMODE NOT = H-FMODE                                     C2643
13080           MOVE ZERO TO F-BREAK                                     C2643
13090           GO TO NEW-TO-MODE.                                       C2643
13100       IF T-FLAGS = 1 GO TO SUB-MODE-TOT-1.                         C2643
13110       IF H-TMODE = ZERO                                            C2643
13120           MOVE T-TMODE TO H-TMODE.                                 C2643
13130       IF T-TMODE NOT = H-TMODE GO TO NEW-TO-MODE.                  C2643
13140                                                                    C2643
13150   PROC-RECORD.                                                     C2643
13160       IF T-FLAGS = 1                                               C2643
13170           GO TO SUB-MODE-TOT-1.                                    C2643
13180       IF T-FLAGS = 2 GO TO SUB-MODE-TOT.                           C2643
13190       IF TS-TIME = ZERO                                            C2643
13200           GO TO READ-LOOP.                                         C2643
13210       IF FIRST-DATA = ZERO                                         C2643
13220           MOVE SPACE TO FIRST-DATA, MOVE ZERO TO W-SUMSQRS.        C2643
13230           COMPUTE W-MEAN ROUNDED = TS-TIME / TS-FREQ.              C2643
13240       COMPUTE W-DIF = T-TIME - W-MEAN.                             C2643
13250       COMPUTE W-SUMSQRS ROUNDED = W-SUMSQRS +                      C2643
13260           W-DIF * W-DIF.                                           C2643
13270       COMPUTE W-DIF = T-TIME - SM-MEAN (T-FMODE9, T-TMODE9).       C2643
13280       COMPUTE SM-SMSQRS (T-FMODE9, T-TMODE9) ROUNDED =             C2643
13290           SM-SMSQRS (T-FMODE9, T-TMODE9) +                         C2643
13300               W-DIF * W-DIF.                                       C2643
13310       ADD T-TIME TO TIME-IN-MODE (T-FMODE9, T-TMODE9).             C2643
13320       GO TO READ-LOOP.                                             C2643
13330                                                                    C2643
13340   SUB-MODE-TOT.                                                    C2643
13350       ADD T-FREQ TO TS-FREQ.                                       C2643
13360       ADD T-TIME TO TS-TIME.                                       C2643
13370       IF T-FMODE9 NOT = 04                                         C2643
13380           GO TO READ-LOOP.                                         C2643
13390       MOVE T-FSUB TO X1.                                           C2643
13400       ADD T-FREQ TO CRUISE-FREQ (X1).                              C2643
13410       ADD T-TIME TO CRUISE-TIME (X1).                              C2643
13420       GO TO READ-LOOP.                                             C2643
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10 - PRINT MODE SUMMARY (cont'd)

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13430                                                              C2643
13440  SUB-MODE-TOT-1.                                             C2643
13450      ADD T-FREQ TO TM-FREQ.                                  C2643
13460      GO TO READ-LOOP.                                        C2643
13470                                                              C2643
13480  FIRST-TIME.                                                 C2643
13490      ALTER FIRST-TIME-SWITCH TO PROCEED TO OTHER-THAN-FIRST-TIME. C2643
13500      GO TO NEW-FROM-MODE.                                    C2643
14010  RESET-CONTROLS.                                             C2643
14020      MOVE T-FMODE TO H-FMODE.                                C2643
14030      MOVE T-TMODE TO H-TMODE.                                C2643
14040      MOVE ZERO TO TS-FREQ,                                   C2643
14050          W-TIME, W-FREQ,                                     C2643
14060          TS-TIME, FIRST-DATA.                                C2643
14070      MOVE SPACE TO F-BREAK, T-BREAK.                         C2643
14080      IF LINCNT GREATER THAN 53                               C2643
14090          PERFORM OVRFL.                                      C2643
14100          WRITE PRT FROM HD5 AFTER 2.                         C2643
14110          WRITE PRT FROM HD6 AFTER 1.                         C2643
14120      GO TO PROC-RECORD.                                      C2643
14130                                                              C2643
14140  NEW-FROM-MODE.                                              C2643
14150      IF LINCNT GREATER THAN 45 PERFORM OVRFL,                C2643
14160          WRITE PRT FROM HD5 AFTER 2,                         C2643
14170          WRITE PRT FROM HD6 AFTER 1.                         C2643
14180      MOVE T-FMODE TO F-MODEF1.                               C2643
14190      MOVE M-DSC (T-FMODE9) TO F-MODEF2.                      C2643
14200      WRITE PRT FROM DET-1 AFTER 2.                           C2643
14210      ADD 2 TO LINCNT.                                        C2643
14220      MOVE ZERO TO TM-FREQ.                                   C2643
14230      GO TO RESET-CONTROLS.                                   C2643
14240                                                              C2643
14250  NEW-TO-MODE.                                                C2643
14260      MOVE H-TMODE TO D-MODET1.                               C2643
14270      MOVE M-DSC    (H-TMODE9) TO D-MODET2.                   C2643
14280      COMPUTE D-FREQ = TS-FREQ.                               C2643
14330      COMPUTE WX ROUNDED = TS-TIME / TS-FREQ.                 C2643
14340      COMPUTE W1 ROUNDED = WX.                                C2643
14350      COMPUTE D-TIME = WX.                                    C2643
14360      PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END. C2643
14370      MOVE HMS-8 TO D-TIME-HMS.                               C2643
14380      IF TS-FREQ = 1                                          C2643
14390          MOVE ZERO TO W-VAR,         ELSE                    C2643
14400              COMPUTE W-VAR      ROUNDED =                    C2643
14410                  W-SUMSQRS / (TS-FREQ - 1.000).              C2643
14420      IF W-VAR LESS THAN 1000000.000                          C2643
14430          COMPUTE D-VARIANCE = W-VAR       ELSE               C2643
14440              MOVE '    *******' TO D-VARX.                   C2643
14450      IF W-VAR = ZERO                                         C2643
14460          MOVE ZERO TO W1.                                    C2643
14470      PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END. C2643
14480      MOVE HMS-8 TO D-DEV-HMS.                                C2643
14490      COMPUTE D-TRANS ROUNDED = (TS-FREQ * 100.00) / TM-FREQ. C2643
14500  NEW-TO-MODE-1.                                              C2643
15010      WRITE PRT FROM DET AFTER 1.                             C2643
15020      ADD 1 TO LINCNT.                                        C2643
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15030      IF L-BREAK = ZERO GO TO CLPP-FINAL-MATRIX.              C2643
15040      IF F-BREAK = ZERO GO TO NEW-FROM-MODE.                  C2643
15050      GO TO RESET-CONTROLS.                                   C2643
15060                                                              C2643
15070  END-FILE.                                                   C2643
15080      MOVE ZERO TO L-BREAK.                                   C2643
15090      CLOSE TAPIN WITH NO REWIND.                             C2643
15100      GO TO NEW-TO-MODE.                                      C2643
15110                                                              C2643
15120                                                              C2643
15130  CLEAR-SUMMARY.                                              C2643
15140      MOVE 1 TO X2.                                           C2643
15150      PERFORM CLEAR-SUMMARY-2 10 TIMES.                       C2643
15160      MOVE 1 TO X2.                                           C2643
15170      PERFORM CLEAR-SUMMARY-3 4 TIMES.                        C2643
15180      ADD 1 TO X1.                                            C2643
15190  CLEAR-SUMMARY-2.                                            C2643
15200      MOVE ZERO TO TIME-IN-MODE (X1, X2).                     C2643
15210      MOVE ZERO TO SM-FREQ (X1, X2), SM-MEAN (X1, X2),        C2643
15220          SM-SMSQRS (X1, X2).                                 C2643
15230      ADD 1 TO X2.                                            C2643
15240  CLEAR-SUMMARY-3.                                            C2643
15250      MOVE ZERO TO RT-MILES (X1, X2), RT-TIME (X1, X2).       C2643
15260      ADD 1 TO X2.                                            C2643
15270  CLEAR-M2.                                                   C2643
15280      MOVE ZERO TO CRUISE-FREQ (X1), CRUISE-TIME (X1),        C2643
15290          ACC-FREQ (X1), ACC-TIME (X1),                       C2643
15300          DEC-FREO (X1), DEC-FREP (X1),                       C2643
15310          DEC-TIMO (X1), DEC-TIMP (X1),                       C2643
15320          ACC-HP (X1), CRUISE-HP (X1),                        C2643
15330          DEC-FREQ (X1), DEC-TIME (X1).                       C2643
15340      ADD 1 TO X1.                                            C2643
15350                                                              C2643
15360  LOAD-INTENSITY SECTION.                                     C2643
15370      MOVE T-FSUB TO X1.                                      C2643
15380      IF T-FLAGS = 1 GO TO ACC-INTENSITY.                     C2643
15390      IF T-FLAGS = 2 GO TO DECO-INTENSITY.                    C2643
15400      IF T-FLAGS = 3 GO TO DECP-INTENSITY.                    C2643
15410      IF T-FLAGS = 5 GO TO ACC-SUM-HP.                        C2643
15420      IF T-FLAGS = 6 GO TO CRUISE-SUM-HP.                     C2643
15430      IF T-FLAGS = 7 GO TO DEC-NO-LOAD.                       C2643
15440      ADD T-FREQ TO DEC-FREQ (X1).                            C2643
15450      ADD T-TIME TO DEC-TIME (X1).                            C2643
15460      GO TO LOAD-INTENSITY-EXIT.                              C2643
15470  ACC-INTENSITY.                                              C2643
15480      ADD T-FREQ TO ACC-FREQ (X1).                            C2643
15490      ADD T-TIME TO ACC-TIME (X1).                            C2643
15500      GO TO LOAD-INTENSITY-EXIT.                              C2643
16010  DECO-INTENSITY.                                             C2643
16020      ADD T-FREQ TO DEC-FREO (X1).                            C2643
16030      ADD T-TIME TO DEC-TIMO (X1).                            C2643
16040      GO TO LOAD-INTENSITY-EXIT.                              C2643
16050  DECP-INTENSITY.                                             C2643
16060      ADD T-FREQ TO DEC-FREP (X1).                            C2643
16070      ADD T-TIME TO DEC-TIMP (X1).                            C2643
16080      GO TO LOAD-INTENSITY-EXIT.                              C2643
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10 - PRINT MODE SUMMARY (cont'd)

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16090  ACC-SLM-HP.                                                         C2643
16100      ADD T-TIME TO ACC-HP (X1).                                      C2643
16110      GO TO LOAD-INTENSITY-EXIT.                                      C2643
16120  CRUISE-SLM-HP.                                                      C2643
16130      ADD T-TIME TO CRUISE-HP (X1).                                   C2643
16140      GO TO LOAD-INTENSITY-EXIT.                                      C2643
16150  DEC-VC-LOAD.                                                        C2643
16160      ADD T-FREQ TO TIME-VC.                                          C2643
16170  LOAD-INTENSITY-EXIT.                                                C2643
16180      EXIT.                                                           C2643
16190                                                                      C2643
16200  LOAD-ROAD-TYPE SECTION.                                             C2643
16210      IF T-FLAGS = 1                                                  C2643
16220          GO TO TRAF-COND.                                            C2643
           IF T-FMODES LESS THAN 04
               ADD T-FREQ TO TT-TIME (T-FMCDE9).
               GO TO LOAD-ROAD-TYPE-EXIT.
16230      COMPUTE X1 = T-FMODE9.                                          C2643
16240      COMPUTE X2 = T-FSUB.                                            C2643
16250      ADD  T-FREQ TO RT-TIME (X1, X2).                                C2643
16250      ADD  T-FREQ TO RT-TIME  (1, X2).
16260      ADD  T-TIME TO RT-MILES (X1, X2).                               C2643
16260      ADD  T-TIME TO RT-MILES  (1, X2).
           ADD T-FREQ TO TT-TIME (4).
16270      GO TO LOAD-ROAD-TYPE-EXIT.                                      C2643
16280  TRAF-COND.                                                          C2643
16290      IF T-FSUB = 1 ADD  T-TIME TO TC-PCT (1).                        C2643
16300      IF T-FSUB = 2 ADD  T-TIME TO TC-PCT (2).                        C2643
16310      IF T-FSUB = 3 ADD  T-TIME TO TC-PCT (3).                        C2643
16320  LOAD-ROAD-TYPE-EXIT.                                                C2643
16330      EXIT.                                                           C2643
16340                                                                      C2643
16350  LOAD-SUMMARY SECTION.                                               C2643
16360      ADD  T-FREQ TO SM-FREQ (T-FMCDE9, T-TMODE9).                    C2643
16370      IF T-FREQ = ZERO                                                C2643
16380          MOVE ZERO TO SM-MEAN (T-FMCDE9, T-TMODE9)  ELSE             C2643
16390              COMPUTE SM-MEAN (T-FMCDE9, T-TMODE9) ROUNDED =          C2643
16400                  T-TIME / T-FREQ.                                    C2643
16410  LOAD-SUMMARY-MODES-EXIT.                                            C2643
16420      EXIT.                                                           C2643
16430                                                                      C2643
16440                                                                      C2643
16450  DUMP-FINAL-MATRIX SECTION.                                          C2643
16460                                                                      C2643
16470      COMPUTE TC-PCT-TOT = TC-PCT (1) + TC-PCT (2) + TC-PCT (3).      C2643
16480      IF TC-PCT-TOT = ZERO GO TO NC-PERCENT.                          C2643
16490      COMPUTE TC-PCT (1) = TC-PCT (1) * 100.00 / TC-PCT-TOT.          C2643
16500      COMPUTE TC-PCT (2) = TC-PCT (2) * 100.00 / TC-PCT-TOT.          C2643
17010      COMPUTE TC-PCT (3) = TC-PCT (3) * 100.00 / TC-PCT-TOT.          C2643
17020      MOVE 1 TO X1.                                                   C2643
17030      MOVE TC-PCT (1) TO TC-PCT-TOT.                                  C2643
17040      IF TC-PCT (2) GREATER THAN TC-PCT (1)                           C2643
17050          MOVE 2 TO X1.                                               C2643
17060          MOVE TC-PCT (2) TO TC-PCT-TOT.                              C2643
17070      IF TC-PCT (3) GREATER THAN TC-PCT-TOT                           C2643
17080          MOVE 3 TO X1.                                               C2643
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17090      IF X1 = 1                                                       C2643
17100      COMPUTE TC-PCT (1) = 100.00 - (TC-PCT (2) + TC-PCT (3)).        C2643
17110      IF X1 = 2                                                       C2643
17120      COMPUTE TC-PCT (2) = 100.00 - (TC-PCT (1) + TC-PCT (3)).        C2643
17130      IF X1 = 3                                                       C2643
17140      COMPUTE TC-PCT (3) = 100.00 - (TC-PCT (1) + TC-PCT (2)).        C2643
17150  NC-PERCENT.                                                         C2643
17160                                                                      C2643
17170                                                                      C2643
17180      IF M-CNT (1) NOT = '  ' ADD 1 TO N-DAYS.                        C2643
17190      IF M-CNT (2) NOT = '  ' ADD 1 TO N-DAYS.                        C2643
17200      IF M-CNT (3) NOT = '  ' ADD 1 TO N-DAYS.                        C2643
17210      IF M-CNT (4) NOT = '  ' ADD 1 TO N-DAYS.                        C2643
17220                                                                      C2643
17230                                                                      C2643
17240      PERFORM OVRFL.                                                  C2643
17250      WRITE PRT FROM HD01 AFTER 2.                                    C2643
17260      WRITE PRT FROM HD7 AFTER 2.                                     C2643
17270      WRITE PRT FROM HD9 AFTER 1.                                     C2643
17280      PERFORM LIST-FREQUENCY.                                         C2643
17290      PERFORM OVRFL.                                                  C2643
17300      WRITE PRT FROM HD02 AFTER 2.                                    C2643
17310      WRITE PRT FROM HD02-1 AFTER 2.                                  C2643
17320      WRITE PRT FROM HD7 AFTER 2.                                     C2643
17330      WRITE PRT FROM HD9 AFTER 1.                                     C2643
17340      PERFORM LIST-MEAN.                                              C2643
17350      PERFORM OVRFL.                                                  C2643
17360      WRITE PRT FROM HD03 AFTER 2.                                    C2643
17370      WRITE PRT FROM HD7 AFTER 2.                                     C2643
17380      WRITE PRT FROM HD9 AFTER 1.                                     C2643
17390      PERFORM LIST-VARIANCE.                                          C2643
17400      IF N-DAYS = 1 GO TO DUMP-TRANS.                                 C2643
17410      PERFORM OVRFL.                                                  C2643
17420      WRITE PRT FROM HD03 AFTER 2.                                    C2643
17430      WRITE PRT FROM HD7 AFTER 2.                                     C2643
17440      WRITE PRT FROM HD9 AFTER 1.                                     C2643
17450      PERFORM LIST-VARIANCE-TRUCK.                                    C2643
17460  DUMP-TRANS.                                                         C2643
17470      PERFORM OVRFL.                                                  C2643
17480      WRITE PRT FROM HD04 AFTER 2.                                    C2643
17490      WRITE PRT FROM HD7 AFTER 2.                                     C2643
17500      WRITE PRT FROM HD9 AFTER 1.                                     C2643
18010      PERFORM LIST-TRANSITION.                                        C2643
18020      PERFORM OVRFL.                                                  C2643
18030      WRITE PRT FROM HD05 AFTER 2.                                    C2643
18040      WRITE PRT FROM HD-CM1 AFTER 2.                                  C2643
18050      WRITE PRT FROM HD-CM2 AFTER 1.                                  C2643
18060      MOVE 1 TO X1.                                                   C2643
18070      PERFORM LIST-CRUISE-MODE 17 TIMES.                              C2643
18080      PERFORM OVRFL.                                                  C2643
18090      WRITE PRT FROM HD06 AFTER 2.                                    C2643
18100      WRITE PRT FROM HD-INT1 AFTER 2.                                 C2643
18110      WRITE PRT FROM HD-INT2 AFTER 1.                                 C2643
18120      WRITE PRT FROM HD-INT3 AFTER 1.                                 C2643
18130      MOVE 1 TO X1.                                                   C2643
18140      PERFORM LIST-INTENSITY 19 TIMES.                                C2643
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10 - PRINT MODE SUMMARY (cont'd)

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18150                                                                  C2643
18160       PERFORM OVRFL.                                             C2643
18170       WRITE PRT FROM HD85  AFTER 2.                              C2643
18180       WRITE PRT FROM HD-HP1 AFTER 2.                             C2643
18190       WRITE PRT FROM HD-HP2 AFTER 1.                             C2643
18200       WRITE PRT FROM HD-HP3 AFTER 1.                             C2643
18210       MOVE 1 TO X1.                                              C2643
18220       PERFORM LIST-HP 15 TIMES.                                  C2643
18230                                                                  C2643
18240       PERFORM OVRFL.                                             C2643
18250       WRITE PRT FROM HD87 AFTER 2.                               C2643
18260       WRITE PRT FROM HD-RT1 AFTER 2.                             C2643
18270       WRITE PRT FROM HD-RT2 AFTER 1.                             C2643
18280       MOVE 4 TO X1.                                              C2643
18290       PERFORM LIST-ROAD-TYPE 8 TIMES.                            C2643
18300       MOVE SPACE TO PRT.                                         C2643
18310       WRITE PRT AFTER 3.                                         C2643
18320       MOVE SPACE TO PRT.                                         C2643
18330       WRITE PRT AFTER 3.                                         C2643
18340       MOVE SPACE TO PRT.                                         C2643
18350       WRITE PRT AFTER 3.                                         C2643
18360       WRITE PRT FROM HD88 AFTER 2.                               C2643
18370       WRITE PRT FROM HD88-1 AFTER 2.                             C2643
18380       MOVE 1 TO X1.                                              C2643
18390       PERFORM LIST-TRAFFIC 3 TIMES.                              C2643
18400                                                                  C2643
18410       COMPUTE W1 ROUNDED = TIME-VC * 0.88                        C2643
18420       PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.  C2643
18430       MOVE HMS-8 TO HD90-1.                                      C2643
18440       MOVE SPACE TO PRT.                                         C2643
18450       WRITE PRT AFTER 2.                                         C2643
18460       WRITE PRT FROM HD90 AFTER 3.                               C2643

            PERFORM OVRFL.
            WRITE PRT FROM HD92 AFTER 3.
            WRITE PRT FROM HD-TIME AFTER 2.
            MOVE 1 TO X1.
            PERFORM LIST-OPERATING-TIME 5 TIMES

18470       CLOSE PRTF.                                                C2643
18480       STOP RUN.
19010                                                                  C2643
19020                                                                  C2643
19030   LIST-FREQUENCY SECTION.                                        C2643
19040       MOVE 1 TO X1.                                              C2643
19050       PERFORM LIST-FREQUENCY-ROW 10 TIMES.                       C2643
19060       GO TO LIST-FREQUENCY-EXIT.                                 C2643
19070   LIST-FREQUENCY-ROW.                                            C2643
19080       MOVE 1 TO X2.                                              C2643
19090       MOVE '   .CO-' TO DET-2.                                   C2643
19100       PERFORM LIST-FREQUENCY-COLUMN 10 TIMES.                    C2643
19110       COMPUTE L-MODE = X1.                                       C2643
19120       MOVE M-DSC (X1) TO L-MODED.                                C2643
19130       WRITE PRT FROM DET-2 AFTER 3.                              C2643
19140       ADD 1 TO X1.                                               C2643
19150   LIST-FREQUENCY-COLUMN.                                         C2643
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19160       MOVE SM-FREQ (X1, X2) TO L-P2 (X2).                        C2643
19170       ADD 1 TO X2.                                               C2643
19180   LIST-FREQUENCY-EXIT.                                           C2643
19190       EXIT.                                                      C2643
19200                                                                  C2643
19210                                                                  C2643
19220   LIST-MEAN SECTION.                                             C2643
19230       MOVE 1 TO X1.                                              C2643
19240       PERFORM LIST-MEAN-ROW 10 TIMES.                            C2643
19250       GO TO LIST-MEAN-EXIT.                                      C2643
19260   LIST-MEAN-ROW.                                                 C2643
19270       MOVE 1 TO X2.                                              C2643
19280       MOVE '   .CO-' TO DET-2.                                   C2643
19290       PERFORM LIST-MEAN-HMS 10 TIMES.                            C2643
19300       COMPUTE L-MODE = X1.                                       C2643
19310       MOVE M-DSC (X1) TO L-MODED.                                C2643
19320       WRITE PRT FROM DET-2 AFTER 3.                              C2643
19330       ADD 1 TO X1.                                               C2643
19340   LIST-MEAN-COLUMN.                                              C2643
19350       MOVE SM-MEAN (X1, X2) TO L-P2 (X2).                        C2643
19360       ADD 1 TO X2.                                               C2643
19370   LIST-MEAN-EXIT.                                                C2643
19380       EXIT.                                                      C2643
19390                                                                  C2643
19400   LIST-MEAN-HMS SECTION.                                         C2643
19410       COMPUTE W1 ROUNDED = SM-MEAN (X1, X2).                     C2643
19420   CONVERT-W1-TO-HH-MM-SS.                                        C2643
19430       MOVE SPACE TO HMS.                                         C2643
19480       COMPUTE W2 = W1 / 3600.                                    C2643
19490           COMPUTE HH = W2.                                       C2643
19500           MOVE '.' TO HMP.                                       C2643
20010           COMPUTE W1 = W1 - (W2 * 3600).                         C2643
20020       MOVE '.' TO MPS.                                           C2643
20030       COMPUTE W2 = W1 / 60.                                      C2643
20040       COMPUTE MM = W2.                                           C2643
20050       COMPUTE SS = W1 - (W2 * 60).                               C2643
20060   CONVERT-HH-MM-SS-END.                                          C2643
20070       NOTE THIS ROUTINE IS PERFORMED AND ALSO                    C2643
20080           IS USED AS A FALL THRU ROUTINE.                        C2643
20090   LIST-MEAN-HMS-1.                                               C2643
20100       MOVE HMS TO L-MC (X2).                                     C2643
20110       ADD 1 TO X2.                                               C2643
20120   LIST-MEAN-HMS-EXIT.                                            C2643
20130       EXIT.                                                      C2643
20140                                                                  C2643
20150                                                                  C2643
20160   LIST-VARIANCE SECTION.                                         C2643
20170       MOVE 1 TO X1.                                              C2643
20180       PERFORM LIST-VARIANCE-ROW 10 TIMES.                        C2643
20190       GO TO LIST-VARIANCE-EXIT.                                  C2643
20200   LIST-VARIANCE-ROW.                                             C2643
20210       MOVE 1 TO X2.                                              C2643
20220       MOVE '   .CO-' TO DET-2.                                   C2643
20230       PERFORM LIST-VARIANCE-COLUMN 10 TIMES.                     C2643
20240       COMPUTE L-MODE = X1.                                       C2643
20250       MOVE M-DSC (X1) TO L-MODED.                                C2643
```

10 - PRINT MODE SUMMARY (cont'd)

```
20260     WRITE PRT FROM DET-2 AFTER 3.                                     C2643
20270     ADD 1 TO X1.                                                      C2643
20280 LIST-VARIANCE-COLUMN.                                                 C2643
20290     IF SM-FREQ (X1, X2) = ZERO OR                                     C2643
20300         SM-MEAN (X1, X2) = ZERO OR                                    C2643
20310         SM-FREQ (X1, X2) = 1                                          C2643
20320         MOVE ZERO TO W-VAR              ELSE                          C2643
20330             COMPUTE W-VAR     ROUNDED = SM-SMSQRS (X1, X2) /          C2643
20340                                  (SM-FREQ (X1, X2) - 1).              C2643
20350     IF W-VAR LESS THAN 100000.000                                     C2643
20360         COMPUTE L-P3 (X2) = W-VAR       ELSE                          C2643
20370             MOVE   '   ********' TO L-PC (X2).                        C2643
20380     ADD 1 TO X2.                                                      C2643
20390 LIST-VARIANCE-EXIT.                                                   C2643
20400     EXIT.                                                             C2643
20410                                                                       C2643
20420                                                                       C2643
20430 LIST-VARIANCE-TRUCK SECTION.                                          C2643
20440     MOVE 1 TO X1.                                                     C2643
20450     PERFORM LIST-VARIANCE-ROW-TRUCK 10 TIMES.                         C2643
20460     GO TO LIST-VARIANCE-TRUCK-EXIT.                                   C2643
20470 LIST-VARIANCE-ROW-TRUCK.                                              C2643
20480     MOVE 1 TO X2.                                                     C2643
20490     MOVE '    .00-' TO DET-2.                                         C2643
20500     PERFORM LIST-VARIANCE-COLUMN-TRUCK 10 TIMES.                      C2643
21010     COMPUTE L-MODE = X1.                                              C2643
21020     MOVE M-DSC (X1) TO L-MODED.                                       C2643
21030     WRITE PRT FROM DET-2 AFTER 3.                                     C2643
21040     ADD 1 TO X1.                                                      C2643
21050 LIST-VARIANCE-COLUMN-TRUCK.                                           C2643
21060     COMPUTE W-VAR = TIME-IN-MODE (X1, X2) -                           C2643
21070         SM-MEAN (X1, X2).                                             C2643
21080     COMPUTE W-VAR = W-VAR * W-VAR / N-DAYS.                           C2643
21090     IF W-VAR LESS THAN 100000.000                                     C2643
21100         COMPUTE L-P3 (X2) = W-VAR       ELSE                          C2643
21110             MOVE   '   ********' TO L-PC (X2).                        C2643
21120     ADD 1 TO X2.                                                      C2643
21130 LIST-VARIANCE-TRUCK-EXIT.                                             C2643
21140     EXIT.                                                             C2643
21150                                                                       C2643
21160                                                                       C2643
21170 LIST-TRANSITION SECTION.                                              C2643
21180     MOVE 1 TO X1.                                                     C2643
21190     PERFORM LIST-TRANSITION-ROW 10 TIMES.                             C2643
21200     GO TO LIST-TRANSITION-EXIT.                                       C2643
21210 LIST-TRANSITION-ROW.                                                  C2643
21220     MOVE 1 TO X2.                                                     C2643
21230     MOVE ZERO TO SUM-ROW.                                             C2643
21240     PERFORM LIST-TRANSITION-SUM 10 TIMES.                             C2643
21250     MOVE 1 TO X2.                                                     C2643
21260     MOVE '    .00-' TO DET-2.                                         C2643
21270     PERFORM LIST-TRANSITION-COLUMN 10 TIMES.                          C2643
21280     COMPUTE L-MODE = X1.                                              C2643
21290     MOVE M-DSC (X1) TO L-MODED.                                       C2643
21300     WRITE PRT FROM DET-2 AFTER 3.                                     C2643
21310     ADD 1 TO X1.                                                      C2643
```

```
21320 LIST-TRANSITION-SUM.                                                  C2643
21330     IF SM-MEAN (X1, X2) NOT = ZERO                                    C2643
21340         ADD SM-FREQ (X1, X2) TO SUM-ROW.                              C2643
21350     ADD 1 TO X2.                                                      C2643
21360 LIST-TRANSITION-COLUMN.                                               C2643
21370     IF SUM-ROW = ZERO      OR                                         C2643
21380         SM-MEAN (X1, X2) = ZERO                                       C2643
21390         MOVE ZERO TO L-P2 (X2)     ELSE                               C2643
21400             COMPUTE L-P2 (X2) ROUNDED =                               C2643
21410                 (SM-FREQ (X1, X2) * 100.00) / SUM-ROW.                C2643
21420     ADD 1 TO X2.                                                      C2643
21430 LIST-TRANSITION-EXIT.                                                 C2643
21440     EXIT.                                                             C2643
21450                                                                       C2643
21460                                                                       C2643
21470 LIST-CRUISE-MODE SECTION.                                             C2643
21480     MOVE MD-CMS (X1) TO CM-SPEED.                                     C2643
21490     MOVE CRUISE-FREQ (X1) TO CM-FREQ.                                 C2643
21500     IF CRUISE-FREQ (X1) = ZERO                                        C2643
22010         MOVE ZERO TO W1  ELSE                                         C2643
22020             COMPUTE W1 ROUNDED = CRUISE-TIME (X1) /                   C2643
22030                 CRUISE-FREQ (X1).                                     C2643
22040     PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.         C2643
22050     MOVE HMS TO CM-TIME.                                              C2643
22060     WRITE PRT FROM CM-DET AFTER 2.                                    C2643
22070     ADD 1 TO X1.                                                      C2643
22080 LIST-CRUISE-MODE-EXIT.                                                C2643
22090     EXIT.                                                             C2643
22100                                                                       C2643
22110                                                                       C2643
22120 LIST-INTENSITY SECTION.                                               C2643
22130     MOVE MD-INTG (X1) TO INT-SPEED.                                   C2643
22140     MOVE ACC-FREQ (X1) TO INT-AFREQ.                                  C2643
22150     IF ACC-FREQ (X1) = ZERO                                           C2643
22160         MOVE ZERO TO W1.  ELSE                                        C2643
22170         COMPUTE W1 ROUNDED = ACC-TIME (X1) /                          C2643
22180             ACC-FREQ (X1).                                            C2643
22190     PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.         C2643
22200     MOVE HMS TO INT-ATIME.                                            C2643
22210     MOVE DEC-FREQ (X1) TO INT-DFREQ.                                  C2643
22220     IF DEC-FREQ (X1) = ZERO                                           C2643
22230         MOVE ZERO TO W1.  ELSE                                        C2643
22240         COMPUTE W1 ROUNDED = DEC-TIME (X1) / DEC-FREQ (X1).           C2643
22250     PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.         C2643
22260     MOVE HMS TO INT-DTIME.                                            C2643
22270     MOVE DEC-FREQ (X1) TO INT-DFREQ.                                  C2643
22280     IF DEC-FREQ (X1) = ZERO                                           C2643
22290         MOVE ZERO TO W1.  ELSE                                        C2643
22300         COMPUTE W1 ROUNDED = DEC-TIME (X1) / DEC-FREQ (X1).           C2643
22310     PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.         C2643
22320     MOVE HMS TO INT-DTIMD.                                            C2643
22330     MOVE DEC-FREQ (X1) TO INT-DFREQ.                                  C2643
22340     IF DEC-FREQ (X1) = ZERO                                           C2643
22350         MOVE ZERO TO W1.  ELSE                                        C2643
22360         COMPUTE W1 ROUNDED = DEC-TIME (X1) / DEC-FREQ (X1).           C2643
22370     PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.         C2643
```

10 - PRINT MODE SUMMARY (cont'd)

```
22380      MOVE HMS TO INT-OTIME.                                          C2643
22390      WRITE PRT FROM IN-DET AFTER 2.                                  C2643
22400      ADD 1 TO X1.                                                    C2643
22410  LIST-INTENSITY-EXIT.                                                C2643
22420      EXIT.                                                           C2643
22430                                                                      C2643
22440                                                                      C2643
22450  LIST-ROAD-TYPE SECTION.                                             C2643
22460      COMPUTE RT-MODEC = X1.                                          C2643
22470      MOVE M-DSC (X1) TC RT-MCDEC.                                    C2643
22480      IF X1 = 11                                                      C2643
22490          MOVE 1 TO X1                                                C2643
22500          MOVE SPACE TO PRT.                                          C2643
23010          WRITE PRT AFTER 1.                                          C2643
23020          MOVE SPACE TO RT-DT.                                        C2643
23030          MOVE 'TOTAL       ' TC RT-MCDEC.                            C2643
23040      MOVE 1 TC X2.                                                   C2643
23050      PERFORM LIST-ROAD-TYPE-1 4 TIMES.                               C2643
23060      WRITE PRT FROM RT-DT AFTER 2.                                   C2643
23070      ADD 1 TO X1.                                                    C2643
23080      GC TO LIST-ROAD-TYPE-EXIT.                                      C2643
23090  LIST-ROAD-TYPE-1.                                                   C2643
23100      MOVE RT-MILES (X1, X2) TC RD-MILES (X2).                        C2643
23110      COMPUTE W1 = RT-TIME (X1, X2).                                  C2643
23120      PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.       C2643
23130      MOVE HMS-8 TC RD-TIME (X2).                                     C2643
23140      ADD 1 TC X2.                                                    C2643
23150  LIST-ROAD-TYPE-EXIT.                                                C2643
23160      EXIT.                                                           C2643
23170                                                                      C2643
23180                                                                      C2643
23190  LIST-TRAFFIC SECTION.                                               C2643
23200      IF X1 = 1 MOVE 'LIGHT  ' TC TC-TYPE.                            C2643
23210      IF X1 = 2 MOVE 'MEDIUM ' TC TC-TYPE.                            C2643
23220      IF X1 = 3 MOVE 'HEAVY  ' TC TC-TYPE.                            C2643
23230      MOVE TC-PCT (X1) TC TD-PCT.                                     C2643
23240      WRITE PRT FROM TC-DT AFTER 2.                                   C2643
23250      ADD 1 TO X1.                                                    C2643
23260  LIST-TRAFFIC-EXIT.                                                  C2643
23270      EXIT.                                                           C2643
23280                                                                      C2643
23290                                                                      C2643
23300  LIST-HP SECTION.                                                    C2643
23310      MOVE SPACE TO HP-DET.                                           C2643
23320      MOVE MD-INTO (X1) TO HP-INT.                                    C2643
23330      MOVE ACC-HP (X1) TC HP-AHP.                                     C2643
23340      COMPUTE W1 ROUNDED = ACC-HP (X1) * 0.88.                        C2643
23350      PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.       C2643
23360      MOVE HMS-8 TC HP-ATIME.                                         C2643
23370      IF X1 GREATER THAN 17 GC TC LIST-HP-WRITE.                      C2643
23380      MOVE MC-CMS (X1) TC HP-SPD.                                     C2643
23390      MOVE CRUISE-HP (X1) TO HP-CHP.                                  C2643
23400      COMPUTE W1 ROUNDED = CRUISE-HP (X1) * 0.88.                     C2643
23410      PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.       C2643
23420      MOVE HMS-8 TO HP-CTIME.                                         C2643
23430  LIST-HP-WRITE.                                                      C2643
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23440      WRITE PRT FROM HP-DET AFTER 2.                                  C2643
23450      ADD 1 TO X1.                                                    C2643
23460  LIST-HP-EXIT.                                                       C2643
23470          EXIT.                                                       C2643
23480                                                                      C2643
23490                                                                      C2643
       LIST-OPERATING-TIME SECTION.
           IF X1 = 5
               MOVE SPACE TO PRT.
               WRITE PRT AFTER 1.
           MOVE OP-TIME (X1) TO OP-MCDE.
           COMPUTE W1 ROUNDED = TT-TIME (X1).
           ADD W1 TO TT-TIME (5).
           PERFORM CONVERT-W1-TO-HH-MM-SS THRU CONVERT-HH-MM-SS-END.
           MOVE HMS-8 TO OP-HMS.
           WRITE PRT FROM OP-TIME-REC AFTER 2.
           ADD 1 TO X1.
       LIST-OPERATING-TIME-EXIT.
           EXIT.

23500  OVRFL SECTION.                                                      C2643
24010      MOVE ZERC TO LINCNT.                                            C2643
24020      ADD 1 TO HD1-PAGE.                                              C2643
24030      WRITE PRT FROM HD1 AFTER 0.                                     C2643
24040      WRITE PRT FROM HD3 AFTER 2.                                     C2643
24050      WRITE PRT FROM HD4 AFTER 1.                                     C2643
24060                                                                      C2643
24070                                                                      C2643
24080  MOVE-HEADER SECTION.                                                C2643
24090      READ TAPIN INTO DUMMY-1       AT END STOP RUN.                  C2643
24100      MOVE DUM-1 TO BYTES-1-19.                                       C2643
24110      READ TAPIN INTO DUMMY-1       AT END STOP RUN.                  C2643
24120      MOVE DUM-1 TO BYTES-20-38.                                      C2643
24130      READ TAPIN INTO DUMMY-1       AT END STOP RUN.                  C2643
24140      MOVE DUM-1 TO BYTES-39-57.                                      C2643
24150      READ TAPIN INTO DUMMY-1       AT END STOP RUN.                  C2643
24160      MOVE DUM-1 TO BYTES-58-76.                                      C2643
24170      MOVE M-TRK-ID TO HD3-TRK-ID.                                    C2643
24180      MOVE '****' TO HD3-CITY.                                        C2643
24190      IF M-CITY = ZERO MOVE 'N.Y.' TC HD3-CITY.                       C2643
24200      IF M-CITY = 1 MOVE 'L.A.' TC HD3-CITY.                          C2643
24210      MOVE M-TYP-TRK TO HD3-TYP.                                      C2643
24220      MOVE 'OTHER ' TO HD3-FUEL.                                      C2643
24230      IF M-FUEL = ZERO MOVE 'GAS   ' TO HD3-FUEL.                     C2643
24240      IF M-FUEL = 1 MOVE 'DIESEL' TC HD3-FUEL.                        C2643
24250      MOVE M-WEIGHT TO HD3-WT.                                        C2643
24260      MOVE M-LICENSE TO HD3-LICENSE.                                  C2643
24270      MOVE M-IND TO HD3-IND.                                          C2643
24280      MOVE M-ENGINE TO HD4-ENGINE.                                    C2643
24290      MOVE M-SERIAL TO HD4-SERIAL.                                    C2643
24300      MOVE M-NDAYS TO HD4-NDAYS.                                      C2643
24310      IF  M-DAYS = SPACE GO TC MCVE-SINGLE-DAY.                       C2643
24320      MOVE '  COMBINED DAYS-' TC HD4-MDAY.                            C2643
24330      MOVE M-DAY TO HD4-CDAYS.                                        C2643
24340      MOVE  M-DAYS TO HD4-CDAYS1.                                     C2643
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24350  Go to Move - Header _ Exit          C2643
24360  Move - Single - Day                 C2643
24370  Move "Day -" To HD4 - SDay          C2643
24380  Move M-Day To HD4 - Day             C2643
24390  Move Header - Exit                  C2643
24400  Exit                                C2643
```

11 - CONDENSE MODE SUMMARY RECORDS

```
// EXEC FCOBOL
 CBL SUMMAP,CLIST
001010 IDENTIFICATION DIVISION.                                         C2766
001020 PROGRAM-ID.  C2766.                                              C2766
001030 REMARKS.      EPA  120210                                        C2766
001040                    MATCH RECORDS ON FLAG, MODE, FLAGS, AND       C2766
001050                    SUMMARIZE TIME AND FREQUENCY.                 C2766
001060     SKIP1                                                        C2766
001070 ENVIRONMENT DIVISION.                                            C2766
001080 INPUT-OUTPUT SECTION.                                            C2766
001090 FILE-CONTROL.                                                    C2766
001100     SELECT TAPE-IN ASSIGN TO SYS012-UT-2400-S.                   C2766
001110     SELECT TAPE-OUT ASSIGN TO SYS014-UT-2400-S.                  C2766
001120     SELECT PRINT-OUT ASSIGN TO SYS009-UP-1403-S                  C2766
001130         RESERVE NO ALTERNATE AREA.                               C2766
001140     SKIP1                                                        C2766
001150 DATA DIVISION.                                                   C2766
001160 FILE SECTION.                                                    C2766
001170 FD  TAPE-IN                                                      C2766
001180     RECORDING MODE IS F                                          C2766
001190     LABEL RECORDS ARE OMITTED                                    C2766
001200     RECORD CONTAINS 20 CHARACTERS                                C2766
002010     BLOCK CONTAINS 101 RECORDS                                   C2766
002020     DATA RECORD IS TAPEN.                                        C2766
002030     SKIP1                                                        C2766
002040 01  TAPEN.                                                       C2766
002050     05  IP-TRUCK                     PIC XX.                     C2766
002060     05  FILLER                       PIC X(8).                   C2766
002070     05  IP-DAY                       PIC X.                      C2766
002080     05  FILLER                       PIC X(8).                   C2766
002090     05  IP-REC-NO                    PIC X.                      C2766
002100     SKIP1                                                        C2766
002110 01  IP REDEFINES TAPEN.                                          C2766
002120     05  IP-REC-MODE                  PIC X(8).                   C2766
002130     05  IP-REC-TIME                  PIC S9(9) COMP-3.           C2766
002140     05  IP-REC-FREQ                  PIC S9(5) COMP-3.           C2766
002150     05  FILLER                       PIC XX.                     C2766
002160     05  IP-REC-FLAGS                 PIC X.                      C2766
002170     05  IP-REC-FLAG                  PIC X.                      C2766
002180     SKIP1                                                        C2766
002190 FD  TAPE-OUT                                                     C2766
002200     RECORDING MODE IS F                                          C2766
003010     LABEL RECORDS ARE OMITTED                                    C2766
003020     RECORD CONTAINS 20 CHARACTERS                                C2766
003030     BLOCK CONTAINS 101 RECORDS                                   C2766
003040     DATA RECORD IS TAPEO.                                        C2766
003050     SKIP1                                                        C2766
003060 01  TAPEO.                                                       C2766
003070     05  FILLER                       PIC X(20).                  C2766
003160     SKIP1                                                        C2766
003170 FD  PRINT-OUT                                                    C2766
003180     RECORDING MODE IS F                                          C2766
003190     LABEL RECORDS ARE OMITTED                                    C2766
003200     RECORD CONTAINS 133 CHARACTERS                               C2766
004010     DATA RECORD IS PRINTAR.                                      C2766
004020     SKIP1                                                        C2766
```

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004030 01  PRINTAR                      PIC X(133).                     C2766
004040     SKIP2                                                        C2766
004050 WORKING-STORAGE SECTION.                                         C2766
004060 77  REC-READ                     PIC 9(5) VALUE 4.               C2766
004070 77  REC-WRIT                     PIC 9(5) VALUE 4.               C2766
004080 77  SKIP                         PIC 9(3) VALUE 014 COMP SYNC.   C2766
004081 77  HLD-TIME                 PICTURE S9(15) COMP-3 VALUE ZEROS.
004082 77  HLD-FREQ                 PICTURE S9(15) COMP-3 VALUE ZEROS.
004083 77  FLAG-ON                      PIC 9 VALUE ZERO.
003080     SKIP1                                                        C2766
003090 01  OP.                                                          C2766
003100     05  OP-REC-MODE              PIC X(8).                       C2766
003110     05  OP-REC-TIME              PIC S9(9) COMP-3.               C2766
003120     05  OP-REC-FREQ              PIC S9(5) COMP-3.               C2766
003130     05  FILLER                   PIC XX.                         C2766
003140     05  OP-REC-FLAGS             PIC X.                          C2766
003150     05  OP-REC-FLAG              PIC X.                          C2766
004090     SKIP1                                                        C2766
004100 01  HD1.                                                         C2766
004110     05  FILLER                   PIC X(9) VALUE ' TRUCK - '.     C2766
004120     05  HD1-TRUCKS               PIC XX   VALUE SPACES.          C2766
004130     05  FILLER                   PIC X(8) VALUE '  DAY - '.      C2766
004140     05  HD1-DAY                  PIC X    VALUE SPACES.          C2766
004150     05  FILLER                   PIC X(10) VALUE SPACES.         C2766
004160     05  HD1-DATE                 PIC X(18) VALUE SPACES.         C2766
004170     05  FILLER                   PIC X(85) VALUE SPACES.         C2766
004180     SKIP1                                                        C2766
004190 01  HD2.                                                         C2766
004200     05  FILLER                   PIC X VALUE SPACES.             C2766
005010     05  HD2-READ                 PIC Z(5).                       C2766
005020     05  FILLER                   PIC X(14) VALUE '  RECORDS READ'.C2766
005030     05  FILLER                   PIC X(113) VALUE SPACES.        C2766
005040     SKIP1                                                        C2766
005050 01  HD3.                                                         C2766
005060     05  FILLER                   PIC X VALUE SPACES.             C2766
005070     05  HD3-WRIT                 PIC Z(5).                       C2766
005080     05  FILLER                   PIC X(17) VALUE                 C2766
005090     '  RECORDS WRITTEN'.                                         C2766
005100     05  FILLER                   PIC X(110) VALUE SPACES.        C2766
005110     EJECT                                                        C2766
005120 PROCEDURE DIVISION.                                              C2766
005130     OPEN INPUT TAPE-IN,
005140          OUTPUT TAPE-OUT WITH NO REWIND, PRINT-OUT.              C2766
005150     ENTER LINKAGE.                                               C2766
005160     CALL 'NOTPAK' USING SKIP.                                    C2766
005170     ENTER COBOL.                                                 C2766
005180     MOVE CURRENT-DATE TO HD1-DATE.                               C2766
005190     MOVE SPACES TO TAPEO, PRINTAR.                               C2766
005200     SKIP1                                                        C2766
006010 READ-FIRST-REC.                                                  C2766
006020     READ TAPE-IN AT END GO TO END-O-FILE.                        C2766
006030     IF IP-REC-NO = 1, MOVE IP-TRUCK TO HD1-TRUCKS.               C2766
006040     IF IP-REC-NO = 3, MOVE IP-DAY TO HD1-DAY.                    C2766
006050     MOVE TAPEN  TO TAPEO.                                        C2766
006060     WRITE TAPEO.                                                 C2766
006070     MOVE SPACES TO TAPEO.                                        C2766
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11 - CONDENSE MODE SUMMARY (cont'd)

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00608C     IF IP-REC-NO = 4, GO TO READ-IP.                         C2766
00609C     GO TO READ-FIRST-REC.                                    C2766
00610C     SKIP1                                                    C2766
00611C READ-IP.                                                     C2766
00612C     READ TAPE-IN AT END GO TO END-O-FILE.                    C2766
00613C     ADD 1 TO REC-READ.                                       C2766
           IF REC-READ = 5 MOVE IP TO OP
               ADD OP-REC-TIME TO HLD-TIME
               ADD OP-REC-FREQ TO HLD-FREQ
               GO TO READ-IP.
006131     IF IP-REC-FLAGS = '3' AND IP-REC-FLAG = '8'
               GO TO WRITE-OP.
00614C     IF IP-REC-FLAG =  OP-REC-FLAG, AND                       C2766
00615C         IP-REC-MODE =  OP-REC-MODE, AND                      C2766
00616C         IP-REC-FLAGS =  OP-REC-FLAGS                         C2766
006161         MOVE 1 TO FLAG-ON
00617C         COMPLTE HLD-TIME = IP-REC-TIME + HLD-TIME
00618C         COMPLTE HLD-FREQ = IP-REC-FREQ + HLD-FREQ
00619C         GO TO READ-IP.                                       C2766
00702C     SKIP1                                                    C2766
00703C WRITE-OP.                                                    C2766
           IF FLAG-ON = 0 GO TO WRITE-BYPASS.
           IF HLD-TIME LESS THAN 1000000000 AND HLD-FREQ
               LESS THAN 100000
               MOVE HLD-TIME TO OP-REC-TIME
               MOVE HLD-FREQ TO OP-REC-FREQ
               GO TO WRITE-BYPASS.
       RE-CHECK.
           IF HLD-TIME GREATER THAN 999999999
               MOVE 1 TO FLAG-ON
               COMPUTE HLD-TIME = HLD-TIME - 999999999
               MOVE 999999999 TO OP-REC-TIME
               ELSE MOVE HLD-TIME TO OP-REC-TIME.
           MOVE HLD-FREQ TO OP-REC-FREQ.
           MOVE ZEROS TO HLD-FREQ.
           IF FLAG-ON = 1 WRITE TAPEO FROM OP ADD 1 TO REC-WRIT
               MOVE ZERO TO FLAG-ON GO TO RE-CHECK.
       WRITE-BYPASS.
00704C     ADD 1 TO REC-WRIT.                                       C2766
           MOVE OP TO TAPEO.
           WRITE TAPEO.
           MOVE IP TO OP.
           MOVE ZERO TO FLAG-ON, HLD-TIME, HLD-FREQ.
           ADD OP-REC-TIME TO HLD-TIME.
           ADD OP-REC-FREQ TO HLD-FREQ.
00708C     GO TO READ-IP.                                           C2766
00709C     SKIP1                                                    C2766
00710C END-O-FILE.                                                  C2766
           ADD 1 TO REC-WRIT.
           IF HLD-TIME = 0 AND HLD-FREQ = 0
               MOVE OP TO TAPEO WRITE TAPEO ELSE
               MOVE HLD-FREQ TO OP-REC-FREQ
               MOVE HLD-TIME TO OP-REC-TIME
               MOVE OP TO TAPEO WRITE TAPEO.
00713C     MOVE REC-READ TO HD2-READ.                               C2766
00714C     MOVE REC-WRIT TO HD3-WRIT.                               C2766
```

```
00715C     WRITE PRINTAR FROM HD1 AFTER POSITIONING 0 LINES.        C2766
00716C     WRITE PRINTAR FROM HD2 AFTER POSITIONING 2 LINES.        C2766
00717C     WRITE PRINTAR FROM HD3 AFTER POSITIONING 1 LINES.        C2766
00718C     MOVE SPACES TO PRINTAR.                                  C2766
00719C     WRITE PRINTAR AFTER POSITIONING 0 LINES.                 C2766
00720C     CLOSE TAPE-IN, PRINT-OUT, TAPE-OUT WITH NO REWIND.
00801C     STOP RUN.
00802C     EJECT                                                    C2766
```

12 - MODE COMBINE TRUCK DAYS

```
// EXEC FCOBOL
 CBL NOTRUNC,CLIST,SUPMAP
010010 IDENTIFICATION DIVISION.
010020 PROGRAM-ID. 'C2767'.                                           C2767
010030 AUTHOR. MLS.                                                   C2767
010040 REMARKS. PROGRAM READS 1 TO 5 FILES SPREAD RANDOMLY AMONG MANY C2767
010050      FILES ON 1 OR 2 INPUT TAPES. OUTPUT IS A STACKED TAPE     C2767
010060      BY TRUCK NUMBER. SYS001 - SYS005 ARE DISK WORK FILES USED C2767
010070      FOR MERGE STEP.                                           C2767
010080 ENVIRONMENT DIVISION.                                          C2767
010082 CONFIGURATION SECTION.                                         C2767
010084 SPECIAL-NAMES.
010086      C01 IS TO-TOP-OF-PAGE.
010090 INPUT-OUTPUT SECTION.                                          C2767
010100 FILE-CONTROL.                                                  C2767
010110      SELECT INPO11 ASSIGN TO  SYS011-UT-2400-S
010115          RESERVE NO ALTERNATE AREA.
010120      SELECT INPO12 ASSIGN TO  SYS012-UT-2400-S
010125          RESERVE NO ALTERNATE AREA.
010130      SELECT OUTO13 ASSIGN TO  SYS013-UT-2400-S
010135          RESERVE NO ALTERNATE AREA.
010140      SELECT WORK01 ASSIGN TO  SYS001-UT-2311-S
010145          RESERVE NO ALTERNATE AREA.
010150      SELECT WORK02 ASSIGN TO  SYS002-UT-2311-S
010155          RESERVE NO ALTERNATE AREA.
010160      SELECT WORK03 ASSIGN TO  SYS003-UT-2311-S
010165          RESERVE NO ALTERNATE AREA.
010170      SELECT WORK04 ASSIGN TO  SYS004-UT-2311-S
010175          RESERVE NO ALTERNATE AREA.
010180      SELECT WORK05 ASSIGN TO  SYS005-UT-2311-S
010185          RESERVE NO ALTERNATE AREA.
010190      SELECT CARDIN ASSIGN TO  SYS007-UR-2540R-S.               C2767
010200      SELECT PRTOUT ASSIGN TO  SYS009-UR-1403-S                 C2767
010205          RESERVE NO ALTERNATE AREA.                            C2767
010210 I-O-CONTROL.                                                   C2767
010220      SAME AREA FOR INPO11 INPO12.                              C2767
                EJECT
020010 DATA DIVISION.                                                 C2767
020020 FILE SECTION.                                                  C2767
020030 FD  INPO11                                                     C2767
020040      BLOCK CONTAINS 101 RECORDS                                C2767
020050      RECORD CONTAINS 20 CHARACTERS                             C2767
020060      LABEL RECORDS ARE OMITTED.                                C2767
020070 01  RECO11  PIC X(20).                                         C2767
020080*                                                               C2767
020090 FD  INPO12                                                     C2767
020100      BLOCK CONTAINS 101 RECORDS                                C2767
020110      RECORD CONTAINS 20 CHARACTERS                             C2767
020120      LABEL RECORDS ARE OMITTED.                                C2767
020130 01  RECO12  PIC  X(20).                                        C2767
020140*                                                               C2767
030010 FD  WORK01                                                     C2767
030020      BLOCK CONTAINS 101 RECORDS                                C2767
030030      RECORD CONTAINS 20 CHARACTERS                             C2767
030040      LABEL RECORDS ARE STANDARD.                               C2767
030050 01  REC01 PIC X(20).
```

```
030130 FD  WORK02
030140      BLOCK CONTAINS 101 RECORDS                                C2767
030150      LABEL RECORDS ARE STANDARD.                               C2767
030160 01  REC02 PIC X(20).                                           C2767
033010 FD  WORK03
033020      BLOCK CONTAINS 101 RECORDS                                C2767
033030      LABEL RECORDS ARE STANDARD.                               C2767
033040 01  REC03 PIC X(20).                                           C2767
033120 FD  WORK04
033130      BLOCK CONTAINS 101 RECORDS                                C2767
033140      LABEL RECORDS ARE STANDARD.                               C2767
033150 01  REC04 PIC X(20).                                           C2767
036010 FD  WORK05
036020      BLOCK CONTAINS 101 RECORDS                                C2767
036030      LABEL RECORDS ARE STANDARD.                               C2767
036040 01  REC05 PIC X(20).                                           C2767
036120 FD  CARDIN                                                     C2767
036130      LABEL RECORDS ARE OMITTED.                                C2767
036140 01  CARD-REC.                                                  C2767
036150      05 TRUCK    PIC 99.                                       C2767
036160      05 FILLER   PIC X.                                        C2767
036170      05 NODAYS   PIC 9.                                        C2767
036175          88 NODAYS-IS-VALID VALUES ARE 1 THRU 5.               C2767
036180      05 FILLER   PIC X.                                        C2767
036190      05 FILES    PIC XXX.                                      C2767
036200          88 ONE-FILES  VALUE 'ONE'.                            C2767
036210          88 TWO-FILES  VALUE 'TWO'.                            C2767
036220      05 FILOPEN  PIC X.                                        C2767
036230          88 OPEN-REWIND  VALUE 'R'.                            C2767
036240      05 FILLER   PIC X(73).                                    C2767
036250*                                                               C2767
039010 FD  PRTOUT                                                     C2767
039020      LABEL RECORDS ARE OMITTED.                                C2767
039030 01  PRINT-REC.                                                 C2767
039040      05 CC        PIC X.                                       C2767
039050      05 PRT-LINE PIC X(132).                                   C2767
039060*                                                               C2767
039070 FD  OUTO13                                                     C2767
039080      BLOCK CONTAINS 101 RECORDS                                C2767
039090      RECORD CONTAINS 20 CHARACTERS                             C2767
039100      LABEL RECORDS ARE OMITTED.                                C2767
039110 01  OUT-REC.                                                   C2767
039120      05 OUT-MODE        PIC X(8).                              C2767
039130      05 OUT-TIME        PIC S9(9) COMP-3.                      C2767
039140      05 OUT-FREQ        PIC S9(5) COMP-3.                      C2767
039150      05 OUT-FILL        PIC XX.                                C2767
039160      05 OUT-FLAGS       PIC X.                                 C2767
039170      05 OUT-FLAG        PIC X.                                 C2767
039180*                                                               C2767
                EJECT
050010 WORKING-STORAGE SECTION.
050020 77  SW-ON PIC X VALUE '*'.
050030 77  SW-OFF PIC X VALUE ' '.
050040 77  SORT-SW PIC X VALUE ' '.
050050 77  SKIPO13 PIC S9(3) COMP SYNC VALUE +13.
050055 77  FL  PIC 9.                                                 C2767
```

12 - MODE COMBINE TRUCK DAYS (cont'd)

```
050600 01  PROGRAM-COUNTERS COMP-3.
050700*    SYSTEM-COUNT KEEPS TRACK OF FILES WRITTEN TO DISK.
050800*    DAY-COUNT    HOLDS NO  DAYS TO BE FOUND.
050900*    ACTIVE-COUNT KEEPS TRACK OF ACTIVE DISK FILES.
051000     05 SYSTEM-COUNT PIC S9 VALUE ZERO.
051100     05 DAY-COUNT    PIC S9 VALUE ZERO.
051200     05 ACTIVE-COUNT PIC S9 VALUE ZERO.
051300*    INPUT-COUNT COUNTS NUMBER OF INPUT-RECORDS.
051400*    OUTPUT-COUNT COUNTS NUMBER OF OUTPUT-RECORDS.
051500     05 INPUT-COUNT  PIC S9(7) VALUE ZERO.
051600     05 OUTPUT-COUNT PIC S9(7) VALUE ZERO.
051700     05 PAGE-COUNT   PIC S9(3) VALUE ZERO.
051800     05  FILE-COUNT   PIC S9(3) VALUE ZERO.
051900     05 LINE-COUNT   PIC S9(3) VALUE ZERO.
052000     05 MAX-LINE    PIC S9(3) VALUE +56.
051080*     WORK ACCUMULATORS
051090     05 ACC-TIME      PIC S9(15) VALUE ZERO.
051100     05 ACC-FREQ      PIC S9(15) VALUE ZERO.
051110*
051120*    MAX-VALUES
051130     05 MAX-TIME      PIC S9(9) VALUE +999999999.
051140     05 MAX-FREQ      PIC S9(5) VALUE +99999.
055010 01  ACTIVE-TABLE.
055020     05 ACT-SW   OCCURS 5 TIMES PIC X.
055030 01  INACTIVE-TABLE.
055040     05 INACT-SW OCCURS 5 TIMES PIC X.
055050*
055060 01  CONTROL-BLOCKS.
055070     05 CB   OCCURS 5 TIMES.
055075       07   CB-KEY.
055080          10 CBFLAG   PIC X.
055090          10 CBMODE   PIC X(8).
055100          10 CBFLAGS  PIC X.
055110       07   CBFILE   PIC X.
055120*
055130 01  SORT-BLOCKS.
055140     05 SB   OCCURS 5 TIMES.
055145       07   SB-KEY.
055150          10 SBFLAG   PIC X.
055160          10 SBMODE   PIC X(8).
055170          10 SBFLAGS  PIC X.
055180       07   SBFILE   PIC X.
055190*
055200 01  HOLD-BLOCK  PIC X(11) VALUE SPACES.
060010 01  OT1.
060020     05 FILLER PIC X(06) VALUE ' FILE '.
060030     05 OT1-F    PIC ZZ9.
060040     05 FILLER PIC X(07) VALUE ' TRUCK '.
060050     05 OT1-T    PIC 99.
060060     05 FILLER PIC X(06) VALUE ' DAYS '.
060070     05 OT1-D  PIC X(09) VALUE SPACES.
060080     05 FILLER PIC X(100) VALUE SPACES.
060090 01  OT2.
060100     05 FILLER PIC X(01) VALUE SPACE.
060110     05 OT2-EDIT  PIC Z,ZZZ,ZZ9.
060120     05 FILLER PIC X(14) VALUE ' RECORDS READ '.
```

```
060130     05 FILLER PIC X(105) VALUE SPACES.
060140 01  OT3.
060150     05  FILLER PIC X VALUE SPACE.
060160     05 OT3-EDIT   PIC Z,ZZZ,ZZ9.
060170     05 FILLER PIC X(17) VALUE ' RECORDS WRITTEN '.
060180     05 FILLER PIC X(106) VALUE SPACES.
060190*
060200*
065010 01  ER1.
065020     05 FILLER PIC X(11) VALUE ' EXPECTING '.
065030     05 ER1-ED1 PIC X VALUE SPACE.
065040     05 FILLER PIC X(16) VALUE ' DAYS FOR TRUCK '.
065050     05 ER1-T   PIC XX.
065060     05 FILLER PIC X(08) VALUE ', FOUND '.
065070     05 ER1-ED2 PIC X VALUE SPACE.
065080     05 FILLER PIC X(9) VALUE '.  USING '.
065090     05 ER1-ED3 PIC X VALUE SPACE.
065100     05 FILLER PIC X VALUE '.'.
065110     05 FILLER PIC X(83) VALUE SPACES.
065120 01  ER2.
065130     05 FILLER PIC X(14) VALUE ' TRUCK NUMBER '.
065140     05 ER2-T  PIC XX VALUE SPACES.
065150     05 FILLER PIC X(18) VALUE '.  NO FILES FOUND.'.
065160     05 FILLER PIC X(99) VALUE SPACES.
070010 01  HD1.
070020     05 FILLER PIC X(42) VALUE ' JOB 120210  EPA  MATCH/MERGE TRUC
070030-        'K DATA  '.
070040     05 HD1-DATE PIC X(8).
070050     05 FILLER PIC X(060) VALUE SPACES.
070060     05 FILLER PIC X(5) VALUE 'PAGE '.
070070     05 HD1-PAGE PIC ZZ,ZZ9.
070080     05 FILLER PIC X(12) VALUE SPACES.
070090*
070100 01  SUBSCRIPTS  COMP SYNC.
070110     05 I   PIC S9(4)  VALUE ZERO.
070120     05 J    PIC S9(4)  VALUE ZERO.
070130     05 K    PIC S9(4)  VALUE ZERO.
070140     05 L    PIC S9(4)  VALUE ZERO.
070150     05 M    PIC S9(4)  VALUE ZERO.
070160     05 N    PIC S9(4)  VALUE ZERO.
075010 01  HOLD-REC1.
075020     05 H-TRUCK  PIC XX.
075030     05 FILLER PIC X(18).
075040 01  HOLD-REC2    PIC X(20).
075050 01  HOLD-REC3.
075060     05 FILLER PIC X(10).
075070     05 H-DESC1.
075080         10 H-DAY PIC X.
075090          10 FILLER PIC X(9).
075100     05 H-DESC2 REDEFINES H-DESC1.
075110          10 H-DAYS PIC X(9).
075120          10 H-NO3  PIC X.
075130 01  HOLD-REC4    PIC X(20).
075140 01  INITIALIZE-HOLD-DAYS.
075150     05 FILLER PIC XX VALUE '9 '.
075160     05 HOLD-DAYS.
```

12 - MODE COMBINE TRUCK DAYS (cont'd)

```
071170          10 HOLD-DAY OCCURS 5 TIMES.
071180              15 H-D PIC X.
071190              15 H-C PIC X.
071200 01  ST-DAY PIC X VALUE SPACE.
080100 01  WORK-RECORDS.                                             C2767
080110     02 WR1.                                                   C2767
030060     05 MODE01   PIC X(8).                                     C2767
030070     05 TIME01   PIC S9(9) COMP-3.                             C2767
030080     05 FREQ01   PIC S9(5) COMP-3.                             C2767
030090     05 FILL01   PIC XX.                                       C2767
030100     05 FLAGS01  PIC X.                                        C2767
030110     05 FLAG01   PIC X.                                        C2767
030120*                                                              C2767
080210     02 WR2.                                                   C2767
030170     05 MODE02   PIC X(8).                                     C2767
030180     05 TIME02   PIC S9(9) COMP-3.                             C2767
030190     05 FREQ02   PIC S9(5) COMP-3.                             C2767
030200     05 FILL02   PIC XX.                                       C2767
030210     05 FLAGS02 PIC X.
030220     05 FLAG02   PIC X.                                        C2767
030230*                                                              C2767
080310     02 WR3.                                                   C2767
033050     05 MODE03   PIC X(8).                                     C2767
033060     05 TIME03   PIC S9(9) COMP-3.                             C2767
033070     05 FREQ03   PIC S9(5) COMP-3.
033080     05 FILL03   PIC XX.                                       C2767
033090     05 FLAGS03  PIC X.                                        C2767
033100     05 FLAG03   PIC X.                                        C2767
033110*                                                              C2767
080410     02 WR4.                                                   C2767
033160     05 MODE04   PIC X(8).                                     C2767
033170     05 TIME04   PIC S9(9) COMP-3.                             C2767
033180     05 FREQ04   PIC S9(5) COMP-3.                             C2767
033190     05 FILL04   PIC XX.                                       C2767
033200     05 FLAGS04  PIC X.                                        C2767
033210     05 FLAG04   PIC X.                                        C2767
033220*                                                              C2767
080510     02 WR5.                                                   C2767
036050     05 MODE05   PIC X(8).                                     C2767
036060     05 TIME05   PIC S9(9) COMP-3.                             C2767
036070     05 FREQ05   PIC S9(5) COMP-3.                             C2767
036080     05 FILL05   PIC XX.                                       C2767
036090     05 FLAGS05  PIC X.                                        C2767
036100     05 FLAG05   PIC X.                                        C2767
036110*                                                              C2767
080610 01  WR-REC.                                                   C2767
080620     05 W-MODE   PIC X(8).                                     C2767
080630     05 W-TIME   PIC S9(9) COMP-3.                             C2767
080640     05 W-FREQ   PIC S9(5) COMP-3.                             C2767
080650     05 W-FILL   PIC XX.                                       C2767
080660     05 W-FLAGS  PIC X.                                        C2767
080670     05 W-FLAG   PIC X.                                        C2767
081010 01  CO-WA  PIC X(10) VALUE HIGH-VALUE.                        C2767
081020 01  CR-CUT PIC X(10) VALUE LOW-VALUE.                         C2767
               EJECT
100010 PROCEDURE DIVISION.                                           C2767
```

```
100020     OPEN INPUT CARDIN                                         C2767
100030          OUTPUT PRTOUT.                                       C2767
100040     MOVE CURRENT-DATE TO HD1-DATE.                            C2767
100050 HEADING-ROUTINE.                                              C2767
100060     ADD 1 TO PAGE-COUNT  MOVE PAGE-COUNT TO HD1-PAGE.         C2767
100070     WRITE PRINT-REC FROM HD1 AFTER ADVANCING TO-TOP-OF-PAGE.  C2767
100080     MOVE SPACES TO PRINT-REC WRITE PRINT-REC AFTER 2.         C2767
100085     MOVE 3 TO LINE-COUNT.
100090 INITIALIZE.                                                   C2767
100100     MOVE ALL '9' TO CONTROL-BLOCKS SORT-BLOCKS.               C2767
100110     MOVE SPACES TO ACTIVE-TABLE INACTIVE-TABLE.               C2767
100120                                                               C2767
               SKIP3
100130 SELECT-RECORDS SECTION.                                       C2767
100140 READ-CONTROL-CARD.                                            C2767
100150     READ CARDIN AT END GO TO EOF-CONTROL-CARD.
100160     IF OPEN-REWIND OPEN INPUT INP011 ELSE OPEN INPUT INP011
100165          WITH NO REWIND.
100170     IF NODAYS-IS-VALID MOVE NODAYS TO DAY-COUNT  ELSE MOVE 5 TO    C2767
100180          DAY-COUNT.                                           C2767
100190     IF TRUCK IS NOT NUMERIC GO TO CONTROL-CARD-ERROR.         C2767
100200*    ALTER ALTERED-GO TO PROCEED TO READ-SYS011.               C2767
110010     MOVE 1 TO SYSTEM-COUNT.                                   C2767
110020     MOVE ZERO TO ACTIVE-COUNT.                                C2767
110030 READ-SYS011.                                                  C2767
110040     READ INP011 INTO HOLD-REC1 AT END GO TO EOF-SYS011.       C2767
110050     IF H-TRUCK NOT EQUAL TO TRUCK GO TO SPACE-FILE.           C2767
110060     GO TO A1 A2 A3 A4 A5 DEPENDING ON SYSTEM-COUNT.           C2767
110070 SPACE-FILE.                                                   C2767
110080     READ INP011 END GO TO READ-SYS011.                        C2767
110090     GO TO SPACE-FILE.                                         C2767
110100*                                                              C2767
110110* A1 - A5 OPEN WORK01 - WORK05 AND COPY 1 FILE FROM SYS011 ONTO    C2767
110120*   THE SELECTED WORK-FILE, THEN FLAG THE WORK-FILE AS ACTIVE AND  C2767
110130*   CLOSE IT.  ALL ROUTINES RETURN CONTROL TO CHECK-COUNT.     C2767
110140*                                                              C2767
110150 A1.                                                           C2767
110160     OPEN OUTPUT WORK01.                                       C2767
110170     ADD  1 TO INPUT-COUNT, ACTIVE-COUNT, SYSTEM-COUNT.
110180     MOVE HOLD-REC1 TO REC01 WRITE REC01.                      C2767
110190 LOOP-A1.                                                      C2767
110200     READ INP011 INTO REC01  AT END GO TO EOF-A1.
110210     WRITE REC01 INVALID KEY GO TO EOF-A1.                     C2767
110220     ADD 1 TO INPUT-COUNT.                                     C2767
110230     GO TO LOOP-A1.
120010 EOF-A1.                                                       C2767
120020     CLOSE WORK01.                                             C2767
120030     GO TO CHECK-COUNT.                                        C2767
120040 A2.                                                           C2767
120050     OPEN OUTPUT WORK02.                                       C2767
120060     MOVE HOLD-REC1 TO REC02 WRITE REC02.                      C2767
120070     ADD 1 TO INPUT-COUNT, ACTIVE-COUNT, SYSTEM-COUNT.
120080 LOOP-A2.                                                      C2767
120090     READ INP011 INTO REC02  AT END GO TO EOF-A2.              C2767
120100     WRITE REC02 INVALID KEY GO TO EOF-A2.                     C2767
120110     ADD 1 TO INPUT-COUNT.                                     C2767
```

12 - MODE COMBINE TRUCK DAYS (cont'd)

```
120120     GO TO LOOP-A2.                                              C2767
120130 EOF-A2.                                                         C2767
120140     CLOSE WORK02.                                               C2767
120150     GO TO CHECK-COUNT.                                          C2767
120160 A3.                                                             C2767
120170     OPEN OUTPUT WORK03.                                         C2767
120180     MOVE HOLD-REC1 TO REC03  WRITE REC03.                       C2767
120190     ADD 1 TO INPUT-COUNT, ACTIVE-COUNT, SYSTEM-COUNT.
120200 LOOP-A3.                                                        C2767
130010     READ INP011 INTO REC03  AT END GO TO EOF-A3.                C2767
130020     WRITE REC03 INVALID KEY GO TO EOF-A3.                       C2767
130030     ADD 1 TO INPUT-COUNT.                                       C2767
130040     GO TO LOOP-A3.                                              C2767
130050 EOF-A3.                                                         C2767
130060     CLOSE WORK03.                                               C2767
130070     GO TO CHECK-COUNT.                                          C2767
130080 A4.                                                             C2767
130090     OPEN OUTPUT WORK04.                                         C2767
130100     MOVE HOLD-REC1 TO REC04  WRITE REC04.                       C2767
130110     ADD 1 TO INPUT-COUNT, ACTIVE-COUNT, SYSTEM-COUNT.
130120 LOOP-A4.                                                        C2767
130130     READ INP011 INTO REC04  AT END GO TO EOF-A4.
130140     WRITE REC04 INVALID KEY GO TO EOF-A4.                       C2767
130150     ADD 1 TO INPUT-COUNT.
130160     GO TO LOOP-A4.                                              C2767
130170 EOF-A4.                                                         C2767
130180     CLOSE WORK04.                                               C2767
130190     GO TO CHECK-COUNT.                                          C2767
140010 A5.                                                             C2767
140020     OPEN OUTPUT WORK05.                                         C2767
140030     MOVE HOLD-REC1 TO REC05  WRITE REC05.                       C2767
140040     ADD 1 TO INPUT-COUNT, ACTIVE-COUNT.                         C2767
140050 LOOP-A5.                                                        C2767
140060     READ INP011 INTO REC05  AT END GO TO EOF-A5.
140070     WRITE REC05 INVALID KEY GO TO EOF-A5.                       C2767
140080     ADD 1 TO INPUT-COUNT.                                       C2767
140090     GO TO LOOP-A5.                                              C2767
140100 EOF-A5.                                                         C2767
140110     CLOSE WORK05.                                               C2767
140120*                                                                C2767
               SKIP3
140130 CHECK-COUNT.                                                    C2767
140140     IF ACTIVE-COUNT LESS THAN DAY-COUNT GO TO READ-SYS011.
140150     CLOSE INP011 WITH NO REWIND.
140160     GO TO MATCH-MERGE.
150010 EOF-SYS011.                                                     C2767
150020     CLOSE INP011.
150030     IF TWO-FILES GO TO TRY-SYS012.                              C2767
150040 CHECK-ACTIVITY.                                                 C2767
150050     IF ACTIVE-COUNT EQUAL TO ZERO GO TO NO-ACTIVITY.            C2767
150060     MOVE DAY-COUNT TO ER1-ED1.                                  C2767
150070     MOVE ACTIVE-COUNT TO ER1-ED2 ER1-ED3.                       C2767
150080     MOVE TRUCK TO ER1-T.                                        C2767
150090     WRITE PRINT-REC FROM ER1 AFTER 2.                           C2767
150100     GO TO MATCH-MERGE.                                          C2767
150110 NO-ACTIVITY.                                                    C2767
150120     MOVE TRUCK TO ER2-T.                                        C2767
150130     WRITE PRINT-REC FROM ER2 AFTER 2.                           C2767
150140     MOVE CARD-REC TO PRT-LINE WRITE PRINT-REC AFTER 1.          C2767
150150     GO TO READ-CONTROL-CARD.                                    C2767
150160 TRY-SYS012.                                                     C2767
150170     OPEN INPUT INP012.
150180 READ-SYS012.                                                    C2767
150190     READ INP012 INTO HOLD-REC1  END GO TO EOF-SYS012.           C2767
150200     IF H-TRUCK NOT EQUAL TO TRUCK GO TO SPACE-FILE-012.         C2767
150210     GO TO B1 B2 B3 B4 B5 DEPENDING ON SYSTEM-COUNT.             C2767
160010 SPACE-FILE-012.                                                 C2767
160020     READ INP012  END GO TO READ-SYS012.                         C2767
160030     GO TO SPACE-FILE-012.                                       C2767
160031 EOF-SYS012.
160032     CLOSE INP012.
160033     GO TO CHECK-ACTIVITY.
               EJECT
160040*                                                                C2767
160050*    B1 - B5 OPEN WORK01 - WORK05 AND COPY 1 FILE FROM SYS012 ONTO  C2767
160060*  THE SELECTED WORK FILE, FLAG THE FILE ACTIVE AND CLOSE IT.    C2767
160070*  ALL ROUTINES RETURN CONTROL TO CHECK-COUNT-012                C2767
160080*                                                                C2767
160090 B1.                                                             C2767
160100     OPEN OUTPUT WORK01.                                         C2767
160110     ADD 1 TO INPUT-COUNT, ACTIVE-COUNT, SYSTEM-COUNT.
160120     MOVE HOLD-REC1 TO REC01  WRITE REC01.                       C2767
160130 LOOP-B1.                                                        C2767
160140     READ INP012 INTO REC01 END GO TO EOF-B1.
160150     WRITE REC01 INVALID KEY GO TO EOF-B1.                       C2767
160160     ADD 1 TO INPUT-COUNT.                                       C2767
160170     GO TO LOOP-B1.                                              C2767
160180 EOF-B1.                                                         C2767
160190     CLOSE WORK01.                                               C2767
160200     GO TO CHECK-COUNT-012.                                      C2767
170010 B2.                                                             C2767
170020     OPEN OUTPUT WORK02.                                         C2767
170030     MOVE HOLD-REC1 TO REC02 WRITE REC02.                        C2767
170040     ADD 1 TO INPUT-COUNT, ACTIVE-COUNT, SYSTEM-COUNT.
170050 LOOP-B2.                                                        C2767
170060     READ INP012 INTO REC02  END GO TO EOF-B2.                   C2767
170070     WRITE REC02  INVALID KEY GO TO EOF-B2.                      C2767
170080     ADD 1 TO INPUT-COUNT.                                       C2767
170090     GO TO LOOP-B2.                                              C2767
170100 EOF-B2.                                                         C2767
170110     CLOSE WORK02.                                               C2767
170120     GO TO CHECK-COUNT-012.                                      C2767
170130 B3.                                                             C2767
170140     OPEN OUTPUT WORK03.                                         C2767
170150     MOVE HOLD-REC1 TO REC03 WRITE REC03.                        C2767
170160     ADD 1 TO INPUT-COUNT, ACTIVE-COUNT, SYSTEM-COUNT.
170170 LOOP-B3.                                                        C2767
170180     READ INP012 INTO REC03  END GO TO EOF-B3.                   C2767
170190     WRITE REC03   INVALID KEY GO TO EOF-B3.
170200     ADD 1 TO INPUT-COUNT.                                       C2767
170210     GO TO LOOP-B3.                                              C2767
170220 EOF-B3.
```

12 - MODE COMBINE TRUCK DAYS (cont'd)

```
17C23C      CLCSE WORKC3.
17C24C      GC TO CHECK-COUNT-C12.
18CC1C B4.
18CC2C      OPEN CUTPUT WORKC4.                                      C2767
18C03C      MOVE HCLD-REC1 TO REC04 WRITE REC04.
18004C      ADD 1 TC INPLT-COUNT, ACTIVE-CCUNT, SYSTEM-CCUNT.        C2767
18C05C LOOP-B4.
18C06C      READ INP012 INTC RECC4  END GC TC EOF-B4.
18C07C      WRITE REC04  INVALID KEY GC TC EOF-B4.                   C2767
18008C      ADD 1 TO INPUT-COUNT.                                    C2767
18009C      GO TC LOOP-B4.                                           C2767
18C10C EOF-B4.                                                       C2767
18011C      CLCSE WORK04.                                            C2767
18012C      GC TO CHECK-COUNT-012.                                   C2767
19C13C B5.                                                           C2767
18014C      OPEN OUTPUT WORK05.                                      C2767
18015C      MOVE HOLD-REC1 TO REC05 WRITE REC05.                     C2767
18016C      ADD 1 TC INPLT-COUNT, ACTIVE-CCUNT, SYSTEM-CCUNT.        C2767
18C17C LCCP-B5.
18018C      READ INP012 INTO REC05  END GC TC EOF-B5.                C2767
18C19C      WRITE RECC5  INVALID KEY GC TC ECF-B5.                   C2767
18C20C      ADD 1 TO INPUT-CCUNT GC TC LCCP-B5.                      C2767
19C01C EOF-B5.  CLOSE WORK05.                                        C2767
19C02C CHECK-COUNT-C12.                                              C2767
190022      IF ACTIVE-COUNT LESS THAN DAY-CCUNT GO TC READ-SYS012.
19C024      GC TO EOF-SYS012.
19C03C*
19004C*   THIS SECTION MATCH/MERGES 2 TC 5 DISK FILES SUMMARIZING    C2767
19005C*  TIME AND FREQUENCY.                                         C2767
19C06C*                                                              C2767
               EJECT                                                 C2767
19C07C MATCH-MERGE SECTION.
190075      OPEN OUTPUT OUT013 WITH NC REWIND.                       C2767
190076      ENTER LINKAGE.                                           C2767
190077      CALL 'NOTPMK' USING SKIP013.
190078      ENTER COBOL.
19008C      MOVE ALL '9' TO CONTRCL-BLCCKS.  MOVE 1 TO I MCVE 0 TO J.
19C085      MOVE INITIALIZE-HOLD-DAYS TC HCLD-DAYS.
190092      MOVE HIGH-VALUE TO WORK-RECCRDS CONTROL-BLCCKS.
19C07C      GC TO F1 F2 F3 F4 F5 DEPENDING CN ACTIVE-CCUNT.          C2767
                 SKIP3
19C100*
190110* F1 - F5 POSITICN WORK01 - WORK05 PAST THE FOUR HEACER RECORDS C2767
19012C* TO THE FIRST CATA RECCRD, SAVING TRUCK-DAY FOR EACH FILE.    C2767
19013C*                                                              C2767
19014C*                                                              C2767
19015C F5.                                                           C2767
19016C      OPEN INPLT WORK05.                                       C2767
19C17C      MOVE 1 TO K.                                             C2767
19018C LCCP-F5. READ WORK05.                                         C2767
190190      IF K EQUAL TC 3 MOVE REC05 TO HCLD-REC3 ADC 1 TO J MCVE  C2767
19C20C            H-DAY TO H-D (J).                                  C
19021C      ACC 1 TO K  IF K NCT GREATER THAN 4 GC TC LCCP-F5.       C2767
19022C      MOVE SW-CN TO ACT-SW (5)                                 C2767
19C23C      READ WORK05 INTO WR5                                     C2767
19024C      MCVE MCDE05 TO CBMCDE (5) MCVE FLAG05 TO CEFLAG (5)
190250          MCVE FLAGS05 TC CBFLAGS (5) MCVE '5' TC CBFILE (5).
20C01C F4. OPEN INPLT WORK04.
200020      MCVE 1 TC K.                                             C2767
20C03C LCCP-F4. READ WCRK04.                                         C2767
2CC04C      IF K EQUAL TO 3 MCVE REC04 TC HCLD-REC3  ACC 1 TC J  MCVE C2767
20C05C            H-DAY TO H-D (J).                                  C2767
20006C      ACC 1 TO K  IF K NCT GREATER THAN 4 GC TC LCCP-F4.       C2767
2CC07C      MOVE SW-CN TC ACT-SW (4).                                C2767
200072      READ WCRK04 INTO WR4                                     C2767
200075      MCVE MODE04 TO CBMCDE (4) MCVE FLAG04 TC CEFLAG (4)
200077          MOVE FLAGS04 TC CBFLAGS (4) MCVE '4' TC CBFILE (4).
20008C F3. OPEN INPLT WCRK03.
20C09C      MCVE 1 TO K.                                             C2767
20010C LOOP-F3. READ WORK03.                                         C2767
200110      IF K EQUAL TC 3 MOVE REC03 TC HCLD-REC3 ACC 1 TC J  MOVE C2767
20012C            H-DAY TO H-D (J).                                  C2767
20013C      ACC 1 TO K IF K NCT GREATER THAN 4 GC TC LCOP-F3.        C2767
20C14C      MCVE SW-CN TO ACT-SW (3).                                C2767
200142      READ WORKC3 INTC WR3                                     C2767
200145      MCVE MODE03 TO CBMCDE (3) MCVE FLAG03 TO CEFLAG (3)
200147          MCVE FLAGS03 TO CBFLAGS (3) MCVE '3' TO CBFILE (3).
200150 F2. OPEN INPLT WORK02.
2C016C      MOVE 1 TO K.                                             C2767
20017C LOOP-F2. READ WORK02.
200180      IF K EQUAL TO 3 MOVE REC02 TC HCLD-REC3  ACC 1 TO J MOVE C2767
200190            H-DAY TO H-D (J).                                  C2767
20020C      ADC 1 TO K  IF K NCT GREATER THAN 4 GC TC LCCP-F2.       C2767
200210      MCVE SW-CN TO ACT-SW (2).                                C2767
20022C      READ WORK02  INTO WR2                                    C2767
200230      MOVE MODE02 TO CBMCDE (2) MCVE FLAG02 TO CEFLAG (2)
200240          MOVE FLAGS02 TO CBFLAGS (2) MCVE '2' TO CBFILE (2).
210010 F1. OPEN INPUT WORK01.
210020      READ WORK01 INTO HCLD-REC1.                              C2767
21003C      READ WORK01 INTO HCLD-REC2.                              C2767
210040      READ WORK01 INTO HCLD-REC3.                              C2767
210050      READ WORK01 INTO HCLD-REC4.                              C2767
210055      MOVE SW-CN TO ACT-SW (1).                                C2767
21006C      ACC 1 TO J MOVE H-DAY TC H-D (J).
210062      READ WORK01 INTO WR1                                     C2767
210064      MOVE MCDE01 TO CBMCDE (1) MCVE FLAG01 TO CEFLAG (1)
210066          MOVE FLAGS01 TC CBFLAGS (1) MOVE '1' TC CBFILE (1).
                 SKIP3
21C07C*
21008C*  NOW SORT THE DAYS IN HOLD-DAYS AND BUILC THE THIRD CLTPUT   C2767
21C09C*   HEACER RECORD.                                             C2767
210100*                                                              C2767
210110 S1.  MOVE SW-OFF TO SORT-SW.                                  C2767.
21012C      MOVE 1 TC N  MOVE 2 TO P.
210130 S2.  IF H-D (N) GREATER  THAN H-D (P) GC TC S4.               C2767
210140 S3.  ADD 1 TO N, P.
210150      IF N LESS THAN 5 GO TO S2.
21016C      IF SORT-SW EQUAL TC SW-CN GC TC S1.
21C17C      GC TO EXIT-SORT01.
21018C S4.  MOVE H-D (N) TC ST-DAY.                                  C2767
21019C      MOVE H-D (P) TO H-D (N).
21020C      MCVE ST-DAY TO H-D (P).                                  C2767
                                                                     C2767
```

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12 - MODE COMBINE TRUCK DAYS (cont'd)

```
.1C11C      MCVE 'W-CW TC SORT-SW.                                         C2767
21C12C      GC T[illegible]
21C2..  [illegible]-SCRTCL.                                                  C2767
1C...       EXAMINE HCLD-DAYS REPLACING ALL '9' BY ' '.
22CC1C*                                                                    C2767
22C02C* NOW SUPPLY COMMAS TO SORTED DAYS IN HOLD-DAYS AND MOVE TO          C2767
22C03C*        HEADER RECORD 3.                                            C2767
22CC4C*                                                                    C2767
22CC5C      GC TC M1 M2 M3 M4 M5 DEPENDING ON J.                           C2767
22C06C M5.  MCVE ',' TO H-C (4).                                           C2767
22CC7C M4.  MCVE ',' TO H-C (3).                                           C2767
22C08C M3.  MCVE ',' TO H-C (2).                                           C2767
22C09C M2.  MCVE ',' TC H-C (1).                                           C2767
22CC94 M1.  MCVE HCLD-DAYS TO H-DESC2.
22CC97      MOVE '3' TC H-NC3.
22C1C1      WRITE CLT-REC FRCM HCLD-REC1.
220102      WRITE CLT-REC FRCM HCLD-REC2.
22C1C3      WRITE CLT-REC FRCM HCLD-REC3.
220104      WRITE CLT-REC FRCM HCLD-REC4  MCVE 4 TC OUTPLT-CCUNT.
                 SKIP3
23C01C CUTPLT-RCUTINE.                                                     C2767
230020      MCVE SPACES TO OUT-REC, MCVE LCW-VALUE TO CB-OUT.              C2767
230C3C OP1. GC TC GET-MERGE-RECORC.                                        C2767
23C032 RS.  IF W-FREG NOT NUMERIC MCVE 0 TC W-FREG.
230034      IF W-TIME NCT NUMERIC MCVE 0 TC W-TIME.
232010      IF OUT-FLAG EQUAL TO '0' ANC CUT-FLAGS EQUAL TC '3'
232020         GO TC OP3.
232030      IF CB-WK EQUAL TO CB-OUT ADD W-FREQ TO ACC-FREG ADC W-TIME TO
23204C         ACC-TIME GO TC GET-MERGE-RECORD.
23501C OP2.
235020      IF ACC-FREQ GREATER THAN MAX-FREG MCVE MAX-FREG TO OUT-FREQ
235036         SUBTRACT MAX-FREQ FRCM ACC-FREG
23504C            ELSE MOVE ACC-FREG TC CUT-FREG SUBTRACT ACC-FREG
23505C          FRCM ACC-FREG.
235060      IF ACC-TIME GREATER THAN MAX-TIME MCVE MAX-TIME TO OUT-TIME
23507C         SUBTRACT MAX-TIME FROM ACC-TIME
235080           ELSE MOVE ACC-TIME TC CUT-TIME SUBTRACT ACC-TIME FROM
23509C                  ACC-TIME.
235100      IF OUT-FREG EQUAL TO ZERO ANC CUT-TIME EQUAL TC ZERO GO TO
23511C         CP3.
23512C      WRITE CUT-REC  ADD 1 TC CUTPUT-CCUNT.
235130      GC TC OP2.
23514C OP3.
23515C      EXIT.
235160 OP4.
235170      MCVE WK-REC TO OUT-REC.
235180      MOVE  W-FREQ TO ACC-FREG MCVE  W-TIME TO ACC-TIME.
23519C      MOVE CB-WK TO CB-OUT.
235200 OP5.
235210      EXIT.
235220 OP6.
23523C      GO TC GET-MERGE-RECORD.
23C12C FILE-CCMPLETE.                                                      C2767
23C11C      PERFCRM CP2 THRU OP3.
23014C*                                                                    C2767
27C15C      CLCSE OUT013 WITH NO REWIND.                                   C2767
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```
27C16C      MCVE H-TRUCK TC DT1-T.                                         C2767
27C17C      ADD 1 TC FILE-COUNT.                                           C2767
27C18C      MCVE FILE-CCUNT TC DT1-F.                                      C2767
27C19C      MCVE H-DAYS TC DT1-D.                                          C2767
27C20C      WRITE PRINT-REC FRCM DT1 AFTER 2.                              C2767
28C01C      MOVE INPUT-CCUNT TC DT2-EDIT.                                  C2767
28C02C      WRITE PRINT-REC FRCM DT2 AFTER 1.                              C2767
28C03C      MOVE OUTPUT-COUNT TO DT3-EDIT.                                 C2767
28C04C      WRITE PRINT-REC FRCM DT3 AFTER 1.                              C2767
28005C      ADD 4 TO LINE-COUNT IF LINE-CCUNT NCT LESS THAN MAX-LINE       C2767
28C06C         PERFORM HEADING-RCUTINE.                                    C2767
28C07C      MOVE ZEROS TC INPUT-COUNT CUTPUT-CCUNT.                        C2767
28C08C      GC TO INITIALIZE.
240002*                                                                    C2767
240004* MERGE-RECORDS THRU C5 MAKES AVAILABLE TC THE CUTPUT-RCUTINE        C2767
24000C*     CNE RECORD FROM THE WORK-FILES, RETURNING CCNTROL TC R9 IF     C2767
24C008*     ANCTHER RECORD IS AVAILABLE, CR TO FILE-COMPLETE IF NOT.       C2767
24001C GET-MERGE-RECCRD.                                                   C2767
24C02C      MOVE 1 TC FL.                                                  C2767
24003C      MCVE WR1 TO WK-REC                                             C2767
24004C      MCVE CB (1) TO CB-WK.                                          C2767
24005C      IF CB (2) IS LESS THAN CB-WK MCVE 2 TO FL                      C2767
24C06C         MOVE WR2 TO WK-REC  MCVE CB (2) TC CB-WK.                   C2767
24007C      IF  CB (3) IS LESS THAN CB-WK MCVE 3 TC FL                     C2767
24C08C         MCVE WR3 TO WK-REC  MCVE CB (3) TO CB-WK.                   C2767
24009C      IF  CB (4) IS LESS THAN CB-WK MCVE 4 TC FL.                    C2767
24C10C         MCVE WR4 TO WK-REC  MCVE CB (4) TO CB-WK.                   C2767
24011C      IF  CB (5) IS LESS THAN CB-WK MCVE 5 TC FL                     C2767
24C12C         MOVE WR5 TO WK-REC  MCVE CB (5) TC CB-WK.                   C2767
24013C      IF  CB-WK EQUAL TO HIGH-VALUE GC TC FILE-CCMPLETE.             C2767
                 SKIP3
24014C*                                                                    C2767
24015C* HERE REPLACE THE APPROPRIATE RECCRD, TEST FCR ECF, CLCSE FILES.    C2767
24016C*       ALL RETURN CONTRCL TC R9.                                    C2767
24017C      GC TC C1 C2 C3 C4 C5 DEPENDING CN FL.                          C2767
24018C C1.  READ WORK01 INTO WR1 ENC MOVE HIGH-VALUE TC WR1 CB (1)         C2767
24C19C         CLOSE WORK01 GO TC R9.                                      C2767
24020C      MCVE MODE01 TO  CBMODE (1) MCVE FLAGS01 TO CBFLAGS (1)         C2767
24021C      MCVE FLAG01 TO  CBFLAG (1) GC TC R9.                           C2767
25001C C2.  READ WORK02 INTO WR2 END MCVE HIGH-VALUE TO WR2 CB (2)
25C02C         CLOSE WORK02 GC TC R9.                                      C2767
25003C      MOVE MODE02 TO CBMCDE (2) MCVE FLAG02 TO CBFLAG (2)            C2767
25004C         MCVE FLAGS02 TC CBFLAGS (2).                                C2767
25C05C      GO TO R9.                                                      C2767
250060 C3.  READ WORK03 INTO WR3 END MCVE HIGH-VALUE TO WR3 CB (3)         C2767
25007C         CLOSE WORK03 GC TO R9.                                      C2767
25008C      MCVE FLAG03 TO CBFLAG (3) MCVE MCDE03 TO CBMCDE (3)            C2767
25009C         MOVE FLAGS03 TO CBFLAGS (3).                                C2767
25010C      GC TO R9.                                                      C2767
250110 C4.  READ WORK04 INTO WR4 ENC MOVE HIGH-VALUE TC WR4 CB (4)         C2767
25012C         CLOSE WORK04 GC TO R9.                                      C2767
25013C      MCVE FLAGS04 TO CBFLAGS (4) MCVE FLAG04 TC CBFLAG (4)          C2767
25014C         MOVE MODE04 TC CBMCDE (4).                                  C2767
25015C      GC TO R9.                                                      C2767
25016C C5.  READ WORK05 INTC WR5 END MCVE HIGH-VALUE TC WR5 CB (5)         C27
25017C         CLOSE WORK05 GO TO R9.                                      C2767
```

12 - MODE COMBINE TRUCK DAYS (cont'd)

```
25C1EC      MCVE MODE05 TU CBMODE (5) MCVE FLAG05 TO CEFLAC (5)          C2767
25C19C          MCVE FLAGS05 TO CBFLAGS (5).                             C2767
25020C      G: TO R9.                                                    C2767
3CC13C ECF-CCNTROL-CARC.                                                 C2767
3CC14C      CLCSF CARDIN.                                                C2767
3C0150* PUT 2 TAPEMARKS ON OUTPUT TAPE.                                  C2767
300160      OPEN OUTPUT OUT013 WITH NC REWIND.                           C2767
3CC17C      CLCSE CUT013.                                                C2767
3CC1EC      CLCSE PRTOUT.
3CC15C      STOP RLN.
31C01C CCNTROL-CARD-ERRCR.
31002C      MOVE ' CCNTROL CARD ERRCR ' TC PRT-LINE.
31C03C      WRITE PRINT-REC AFTER 2.
31004C      MOVE CARD-REC TO PRT-LINE WRITE PRINT-REC AFTER 1.
31C05C      GO TO READ-CCNTROL-CARD.
```

13 - LIST FIRST 80 CHARACTERS EACH FILE - (Debug Aid)

```
// EXEC ASSEMBLY
         TITLE 'LIST HEADERS    120210 ABC'                   CCW      CCW  2,CD,0,80
         PRINT NOGEN                                          CCB      CCB  SYSIPT,CCW
         ENTER R12                                            CD       DS   CL80
         USING T1,R11                                                  LTORG
         EXCP CCB                                             CC       DS   CL1
         WAIT CCB                                             PR       DS   CL132
         PACK  CD(4),CD(4)                                    T1       DS   CL80
         CP    CD(4),=P'0'                                             END
         BNE    *+4+6
         ZAP   CD(4),=P'9999'
         LA    R13,=9D'0'
         CALL  GETDAT,(DATE)
         MVI   CC,X'8B'
         BAL   R9,WSYSLST
         XC    PR,PR
         MVC   PR(7),CD+10
         MVC   PR+25(18),DATE
         MVI   CC,17
WR       BAL   R9,WSYSLST
READ     BAL   R9,RSYS011
         MVI   SW1,1
         CLI   SW,1
         BE    PRT
         B     READ
PRT      XC    PR,PR
         MVI   CC,9
         AP     KNT,=P'1'
         OI    KNT+L'KNT-1,15
         UNPK  PR(4),KNT
         MVC   PR+9(80),T1
         MVI   SW,0
         B     WR
         SPACE
EOF      AP    CNT,=P'1'
         CP    CD(4),CNT
         BE    EOJ
         CLI   SW1,0
         BE    EOJ
         MVI   SW1,0
         MVI   SW,1
         XC    PR,PR
         MVI   CC,9
         BSP   SYS011
         B     WR
EOJ      RWU   SYS011
         MVI   CL,15
         BAL   R9,WSYSLST
         EOJ
SW       DC    X'01'
SW1      DC    X'00'
WSYSLST  PRT   R9,SYSLST,CC,133,OV,CL
RSYS011  RT    R9,SYS011,T1,R11,80,80,EOF,,WLR,0,0
DATE     DC    CL18' '
CNT      DC    PL3'0'
KNT      DC    PL3'0'
```

14 - CALIBRATED & RAW LISTING

```
// EXEC FCCBCL
     ICENTIFICATION DIVISION.
     PHCCRAM-IC.  'EPA'.
     REMARKS.
     ENVIRCNMENT CIVISION.
     INPLT-CLTPLT SECTION.
     FILE-CCNTROL.
         SELECT TAPE-CALIB ASSIGN TC SYSC11-UT-2400-S.
         SELECT TAPE-RAW ASSIGN TC SYS012-UT-2400-S.
         SELECT PRINT-OUT ASSIGN TC SYS009-UR-1403-S
             RESERVE NO ALTERNATE AREA.
     CATA CIVISION.
     FILE SECTION.
     FC  TAPE-CALIB
         LABEL RECORDS ARE CHITTED
         RECCRC CONTAINS 40 CHARACTERS
         BLOCK CCNTAINS 270 RECCRDS.
     G1  CALIB.
         05  CALIB-HEAD.
             1C  TRUCK-ID               FIC XX.
             1C  COLS REDEFINES TRUCK-IC.
                 15  CALIB-AST          PIC X.
                 15  FILLER             PIC X.
             10  CITY                   PIC X.
             1C  TYPE-TRUCK             FIC X.
             10  FUEL-TYPE              PIC X.
             10  HEIGHT                 PIC XX.
             10  LICENSE                PIC X(8).
             10  CLASS                  FIC XX.
             1C  ENGINE-MODEL           FIC X(10).
             10  ENGINE-NO1             FIC X(13).
         05  CALIB-HEAD2 REDEFINES CALIB-HEAD.
             10  ENGINE-NO2             PIC X(7).
             10  NO-DAYS                FIC X.
             10  DAYS                   PIC X.
             10  FILLER                 PIC X(31).
         05  CALIB-DATA REDEFINES CALIB-HEAD.
             10  CALIB-TRUCK-ID         PIC XX.
             10  FILLER                 FIC X(6).
             1C  CALIB-RPM              CCMP-1.
             1C  CALIB-HORSE-POWER      COMP-1.
             1C  CALIB-VEH-SPEED        CCMP-1.
             10  CALIB-RD-TYPE          CCMP-1.
             10  CALIB-TRAF-COND        CCMP-1.
             10  CALIB-VALVE-CLCSEC     CCMP-1.
             10  CALIB-ENGINE-TEMP      CCMP-1.
             1C  CALIB-VS-MULTI         CCMP-1.
     FD  TAPE-RAW
         LABEL RECORDS ARE CHITTEC
         RECCRD CONTAINS 30 CHARACTERS
         BLOCK CONTAINS 120 RECCRDS.
     01  RAW.
         05  RAW-TRUCK-ID               FIC XX.
         C5  COL REDEFINES RAW-TRUCK-IC.
             1C  RAW-AST                PIC X.
             10  FILLER                 PIC X.
```

```
         C5  RAW-TIME                   PIC S99V99.
         05  RAW-RPM                    PIC SV999.
         C5  RAW-LOAD-FAC               FIC SV999.
         C5  RAW-VEH-SPEED              PIC SV999.
         05  RAW-RD-TYPE                PIC SV999.
         05  RAW-TRAF-CONDS             FIC SV999.
         C5  RAW-VALVE-CLOSED           FIC SV999.
         C5  RAW-ENGINE-TEMP            FIC SV999.
         C5  RAW-VS-FLAG                PIC SV999.
     C1  RAW-DATA REDEFINES RAW.
         05  FILLER                     FIC X(18).
         05  RAW-DAYS                   FIC X.
         C5  FILLER                     PIC X(11).
     FC  PRINT-OUT
         LABEL RECORDS ARE CHITTEC.
     01  PRINTAR.
         05  FILLER                     PIC X.
         05  PRINT.
             1C  PRINT1                 PIC X(4C).
             1C  PRINT2                 PIC X(92).
     WORKING-STORAGE SECTION.
     77  LINE-CNT                       PIC 99 VALUE ZERC.
     77  CCUNT                          PIC 9(6) VALUE ZERC.
     77  COUNT-100                      PIC 999 VALUE ZERO.
     77  CCUNT-1000                     PIC 9(4) VALLE ZERC.
     77  PROCESS-TIMES                  FIC 9 VALUE ZERC.
     77  SW                             PIC 9 VALUE ZERC.
     77  AST-SW                         PIC X VALUE SPACES.
     01  HLD-REC.
         05  HLD-TRK                    PIC XX VALUE SPACES.
         05  HLD-DAYS                   PIC  X VALLE SPACES.
         05  HLD-R-TRK                  PIC XX VALUE SPACES.
         05  HLD-R-DAYS                 PIC X  VALUE SPACES.
     01  HEAD1.
         05  FILLER                     FIC X.
         C5  HD1                        PIC XX.
         05  FILLER                     PIC X.
         05  HD2                        PIC X.
         05  FILLER                     FIC X.
         05  HD3                        FIC X.
         05  FILLER                     PIC X.
         05  HD4                        PIC X.
         05  FILLER                     PIC X.
         05  HD5                        PIC X.
         05  FILLER                     PIC X.
         05  HD6                        FIC X(8).
         05  FILLER                     FIC X.
         C5  HD7                        PIC XX.
         05  FILLER                     FIC X.
         C5  HD8                        PIC X(10).
         C5  FILLER                     FIC X.
         C5  HD9                        PIC X(13).
         C5  HD10                       FIC X(7).
         05  FILLER                     PIC X.
         C5  HD11                       PIC X.
         C5  FILLER                     PIC X.
```

14 - CALIBRATE & RAW LISTING (cont'd)

```
       05  HD12                     PIC X.
       05  FILLER                   PIC X.
       05  FILLER                   PIC X(50).
       05  DATE                     PIC X(18).
   01  HEAD2.
       05  FILLER                   PIC X VALUE SPACES.
       05  FILLER                   PIC X(6) VALUE 'RECORD'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC XXX VALUE 'TRK'.
       05  FILLER                   PIC XXX VALUE SPACES.
       05  FILLER                   PIC X(4) VALUE 'TIPE'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC X(10) VALUE '          3'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC X(10) VALUE '          4'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC X(10) VALUE '          5'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC X(10) VALUE '          6'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC X(10) VALUE '          7'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC X(10) VALUE '          8'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC X(10) VALUE '          9'.
       05  FILLER                   PIC XX VALUE SPACES.
       05  FILLER                   PIC X(10) VALUE '         10'.
       05  FILLER                   PIC X(31) VALUE SPACES.
   01  PRINT-RAW.
       05  FILLER                   PIC X.
       05  PR-REC                   PIC Z(6).
       05  FILLER                   PIC XXX.
       05  PR-TRK                   PIC XX.
       05  FILLER                   PIC XX.
       05  PR-TIME                  PIC 99.99.
       05  FILLER                   PIC X(12).
       05  PR-3                     PIC -.999.
       05  FILLER                   PIC X(7).
       05  PR-4                     PIC -.999.
       05  FILLER                   PIC X(7).
       05  PR-5                     PIC -.999.
       05  FILLER                   PIC X(7).
       05  PR-6                     PIC -.999.
       05  FILLER                   PIC X(7).
       05  PR-7                     PIC -.999.
       05  FILLER                   PIC X(7).
       05  PR-8                     PIC -.999.
       05  FILLER                   PIC X(7).
       05  PR-9                     PIC -.999.
       05  FILLER                   PIC X(7).
       05  PR-10                    PIC -.999.
       05  FILLER                   PIC X(23).
   01  PRINT-CALIB.
       05  FILLER                   PIC X.
       05  PC-REC                   PIC Z(6).
       05  FILLER                   PIC XXX.
       05  PC-TRK                   PIC XX.
       05  FILLER                   PIC X(9).
       05  PC-3                     PIC -(6).999.
       05  FILLER                   PIC XX.
       05  PC-4                     PIC -(6).999.
       05  FILLER                   PIC XX.
       05  PC-5                     PIC -(6).999.
       05  FILLER                   PIC XX.
       05  PC-6                     PIC -(6).999.
       05  FILLER                   PIC XX.
       05  PC-7                     PIC -(6).999.
       05  FILLER                   PIC XX.
       05  PC-8                     PIC -(6).999.
       05  FILLER                   PIC XX.
       05  PC-9                     PIC -(6).999.
       05  FILLER                   PIC XX.
       05  PC-10                    PIC -(6).999.
       05  FILLER                   PIC X(18).
   PROCEDURE DIVISION.
       OPEN INPUT TAPE-RAW WITH NO REWIND
            TAPE-CALIB WITH NO REWIND
            OUTPUT PRINT-OUT.

       MOVE SPACES TO HEAD1, PRINTAR, PRINT-RAW, PRINT-CALIB.
       ENTER LINKAGE.
       CALL 'GETDAT' USING DATE.
       ENTER COBOL.
       READ TAPE-CALIB AT END GO TO STOP-RUN.
       MOVE TRUCK-ID TO HD1, HLD-TRK.
       MOVE CITY TO HD2.
       MOVE TYPE-TRUCK TO HD3.
       MOVE FUEL-TYPE TO HD4.
       MOVE WEIGHT TO HD5.
       MOVE LICENSE TO HD6.
       MOVE CLASS TO HD7.
       MOVE ENGINE-MODEL TO HD8.
       MOVE ENGINE-NO1 TO HD9.
       READ TAPE-CALIB AT END GO TO STOP-RUN.
       MOVE ENGINE-NO2 TO HD10.
       MOVE NO-DAYS TO HD11.
       MOVE DAYS TO HD12, HLD-DAYS.
       MOVE SPACES TO PRINTAR.
       WRITE PRINTAR AFTER POSITIONING 0 LINES.
       MOVE 1 TO SW.

   READ-CALIB-AST.
       READ TAPE-CALIB AT END GO TO STOP-RUN.
       MOVE CALIB TO PRINT1.
       IF CALIB-AST = '*' MOVE '*' TO AST-SW.
       READ TAPE-CALIB AT END GO TO STOP-RUN.
       MOVE CALIB TO PRINT2.
       WRITE PRINTAR AFTER POSITIONING 1 LINES.
       MOVE SPACES TO PRINTAR.
       IF AST-SW = '*' GO TO READ-RAW-AST.
       GO TO READ-CALIB-AST.
   READ-RAW-AST.
```

14 - CALIBRATE & RAW LISTING (cont'd)

```
    MGVE SPACES TO AST-SW.
    REAC TAPE-RAW AT END GC TC STCF-RUN.
    IF SW = 1 MCVE RAW-TRUCK-IG TC HLD-R-TRK.
    IF RAW-AST = '*' MGVE '*' TC AST-SW.
    REAC TAPE-RAW AT END GC TC STCF-RUN.
    IF SW = 1 MCVE RAW-DAYS TC HLD-R-DAYS
        MOVE 0 TO SW.
    IF HLD-R-DAYS NOT = HLC-CAYS CR
        HLD-R-TRK NOT = HLC-TRK
        MOVE 'HEADINGS DO ACT PATCH - JCB ABCRTEC' TO PRINT
        WRITE PRINTAR AFTER PCSITICAING 0 LINES
        MOVE SPACES TO PRINTAR
        MOVE HLD-REC TC PRINT
        WRITE PRINTAR AFTER PCSITICAING 2 LINES
        GO TC READ-CALIB-END.
    READ TAPF-RAW AT END GC TC STGP-RUN.
    IF AST-SW = '*'
        WRITL PRINTAR FROM HEAD1 AFTER FCSITIONING 0 LINES
        WRITC PRINTAR FROP HEAC2 AFTER FCSITIONING 2 LINES
        MOVE SPACES TC PRINTAR
        ADD 2 TC LINE-CNT
        GO TG READ-TAPES.
    GO TO READ-RAW-AST.

READ-TAPES.
    REAC TAPE-CALIB AT END GC TC READ-RAW-END.
    REAC TAPE-RAW AT END GC TO STOP-RUN.
    ACC 1 TO COUNT.
AST-FINL.
    IF COUNT-100 GREATER THAN 0 GC TO PRINT-100.
    IF CALIB-VEH-SPEED GREATER THAN .999
        GO TO PRINT-10C.
    GC TO READ-TAPES.

PRINT-1CO.
    MCVE COUNT TO PC-REC.
    MCVE RAW-TRUCK-ID TO PR-TRK.
    MCVE RAW-TIME TO PR-TIPE.
    MGVE RAW-RPM TO PR-3.
    MGVE RAW-LOAD-FAC TO PR-4.
    MOVE RAW-VEH-SPEED TO PR-5.
    MOVE RAW-RD-TYPE TC PR-6.
    MOVE RAW-TRAF-CONDS TO PR-7.
    MOVE RAW-VALVE-CLCSED TC PR-8.
    MCVE RAW-ENGINE-TEPP TC PR-9.
    MCVE RAW-VS-FLAG TG PR-1C.
    WRITE PRINTAR FROM PRINT-RAW AFTER POSITIONING 1 LINES.
    MOVE SPACES TC PRINT-RAW.
    MOVE CALIB-RPM TO PC-3.
    MOVE CALIB-HORSE-PCWER TO PC-4.
    MOVE CALIB-VEH-SPEED TC PC-5.
    MOVE CALIB-RD-TYPE TO PC-6.
    MCVE CALIB-TRAF-COND TC PC-7.
    MCVE CALIB-VALVE-CLOSEC TC PC-8.
    MOVE CALIB-ENGINE-TEMP TO PC-9.
    MOVE CALIB-VS-MULTI TC FC-10.
```

```
    WRITE PRINTAR FROM PRIAT-CALIB AFTER POSITIGNING 1 LINES.
    MOVE SPACES TO PRIAT-CALIB.
    ACC 2 TO LINE-CNT.
    ACC 1 TO COUNT-100.
    IF COUNT-100 GREATER THAN 99 MOVE 0 TO CCUAT-100
        ACC 1 TC PROCESS-TIPES
        GO TO READ-1000.

    IF LINE-CNT GREATER THAN 54
        MOVE 2 TO LINE-CNT
        WRITE PRINTAR FROM HEAD1 AFTER POSITIONING 0 LINES
        WRITE PRINTAR FROM HEAD2 AFTER PCSITIONING 2 LINES.
    GO TO READ-TAPES.
READ-1CCO.
    IF PROCESS-TIMES = 6, GC TC REAC-CALIB-ENC.
    ADD 1 TO COUNT-1000.
    READ TAPE-CALIB AT END GO TG READ-RAW-ENC.
    REAC TAPE-RAW AT END GC TC STCP-RUN.
    ADD 1 TO COUNT.
    IF COUNT-1000 = 1000 MCVE ZERC TO CCUNT-1000
        GO TC READ-TAPES.
    GO TO READ-1000.
READ-CALIB-END.
    READ TAPE-CALIB AT END GO TO READ-RAW-ENC.
    GO TO READ-CALIB-END.
READ-RAW-END.
    READ TAPE-RAW AT END GC TC STCP-RUN.
    GO TO READ-RAW-END.
STOP-RUN.
    CLOSE TAPE-CALIB WITH NC REWINC, TAPE-RAW WITH NO REWIND
        PRINT-OUT.
    STOP RUN.
```

15 - MODE-PRINT SPOOLED OUTPUT

```
// EXEC COBOL                                                                          PRTF.
01010  IDENTIFICATION DIVISION.                                                   STOP RUN.
01020  PROGRAM-ID.  'SPOOL'.
01030  ENVIRONMENT DIVISION.
01040  INPUT-OUTPUT SECTION.
01050  FILE-CONTROL.
01060      SELECT CRDR ASSIGN 'SYS007' UNIT-RECORD 2540R.
01080      SELECT PRTF ASSIGN 'SYS009' UNIT-RECORD 1403.
01070      SELECT TAPIN ASSIGN 'SYS011' UTILITY 2400.
01090  DATA DIVISION.
01100  FILE SECTION.


01120  FD  CRDR
01130          RECORDING MODE F, LABEL RECORDS OMITTED,
01140          DATA RECORD CARD-IN.
01150  01  CARD-IN.
           07  WHICH-FILE     PICTURE 9999.
           07  FILLER         PICTURE X.
           07  NO-COPIES      PICTURE 9999.
01120  FD  PRTF
01130          RECORDING MODE F, LABEL RECORDS OMITTED,
01140          DATA RECORD PRT.
01150  01  PRT.
01160      07  CC   PICTURE X.
01170      07  PRT1 PICTURE X(81).
01180      07  PRT2 PICTURE X(51).


01200  FD  TAPIN
01210      RECORDING MODE F, LABEL RECORDS OMITTED,
                   BLOCK CONTAINS 50 RECORDS,
                   RECORD CONTAINS 133 CHARACTERS,
                   DATA RECORD IS SPOOL-IN.
       01  SPOOL-IN.
           07  SPOOL-CC       PICTURE X.
           07  SPOOL-IMAGE    PICTURE X(132).


02100  WORKING-STORAGE SECTION.


       01  CONSTANTS.
           07  C-CTL     PICTURE X.
       PROCEDURE DIVISION.
           OPEN OUTPUT PRTF,
           INPUT TAPIN WITH NO REWIND.
       READ-DS.
           READ TAPIN AT END GO TO END-FILE.
           MOVE SPOOL-IN TO PRT.
           MOVE SPOOL-CC TO C-CTL.
           WRITE PRT AFTER C-CTL.
           GO TO READ-DS.

       END-FILE.
           CLOSE TAPIN WITH NO REWIND,
```

16 - APPLY INITIAL EDIT - LOAD OPEN & CLOSED VALVE READINGS

```
// EXEC COBOL
      IDENTIFICATION DIVISION.
      PROGRAM-ID.  'EPA'.
      ENVIRONMENT DIVISION.
      INPUT-OUTPUT SECTION.
      FILE-CONTROL.
          SELECT CARD-IN ASSIGN 'SYS007' UNIT-RECORD 2540R.
          SELECT TAPE-IN ASSIGN 'SYS011' UTILITY 2400.
          SELECT TAPE-OUT ASSIGN 'SYS012' UTILITY 2400.
      DATA DIVISION.
      FILE SECTION.
      FD  CARD-IN
          RECORDING MODE IS F
          LABEL RECORDS ARE OMITTED
          RECORD CONTAINS 80 CHARACTERS
          DATA RECORD IS CARDN.
      01  CARDN.
          05  X-VALU                      PICTURE 999.
          05  FILLER                      PICTURE X.
          05  X-OPEN-1                    PICTURE X(4).
          05  X-OPEN-2                    PICTURE X.
          05  FILLER                      PICTURE X.
          05  X-CLS                       PICTURE X(5).
          05  FILLER                      PICTURE X(65).
      FD  TAPE-IN
          RECORDING MODE IS F
          LABEL RECORDS ARE OMITTED
          RECORD CONTAINS 40 CHARACTERS
          BLOCK CONTAINS 090 RECORDS
          DATA RECORD IS IP.
      01  IP.
          05  AST                         PICTURE X.
          05  FILLER                      PICTURE X(7).
          05  CHANNELS  COMPUTATIONAL-1.
              10  CH-3.
              10 CH-4.
              10  CH-5.
              10  CH-6.
              10  CH-7.
          05  CH-8                        PICTURE SV999.
          05  FILLER                      PICTURE X.
          05  FILLER                      PICTURE X(8).
      FD  TAPE-OUT
          RECORDING MODE IS F
          LABEL RECORDS ARE OMITTED
          RECORD CONTAINS 40 CHARACTERS
          BLOCK CONTAINS 090 RECORDS
          DATA RECORD IS OP.
      01  OP.
          05  FILLER                      PICTURE X(8).
          05  OP-CHANNELS  COMPUTATIONAL-1.
              10  OP-CH-3.
              10  OP-CH-4.
              10  OP-CH-5.
              10  OP-CH-6.
              10  OP-CH-7.
              10  OP-CH-8.
          05  FILLER                      PICTURE X(8).
      WORKING-STORAGE SECTION.
      77  SKIP           PICTURE S99 VALUE 12 COMPUTATIONAL.
      77  COUNT                           PICTURE 99 VALUE ZERO.
      77  HLD-OPEN                        PICTURE X(4) VALUE 'OPEN'.
      77  HLD-CLS                         PICTURE X(6) VALUE 'CLOSED'.
      77  VALUE-05                        COMPUTATIONAL-1.
      77  VALUE-X                         COMPUTATIONAL-1.
      77  VALUE-100                       COMPUTATIONAL-1.
      01  HLD-REC.
          05  HLD-REC-1.
              10  FILLER                  PICTURE X(31).
              10  REC-OPEN                PICTURE X(4).
              10  FILLER                  PICTURE X.
              10  REC-1                   PICTURE X(4).
          05  HLD-REC-2.
              10  REC-1-1                 PICTURE X.
              10  FILLER                  PICTURE X.
              10  REC-CLS                 PICTURE X(6).
              10  FILLER                  PICTURE X.
              10  REC-2                   PICTURE X(5).
              10  FILLER                  PICTURE X(26).
      PROCEDURE DIVISION.
          OPEN INPUT CARD-IN, TAPE-IN WITH NO REWIND
               OUTPUT TAPE-OUT WITH NO REWIND.
          ENTER LINKAGE.
          CALL 'NCTPMK' USING SKIP.
          ENTER COBOL.
           MOVE SPACES TO OP.
          READ CARD-IN AT END GO TO STOP-RUN.
          MOVE X-VALUE TO VALUE-X.
          MOVE 0.5 TO VALUE-05.
          MOVE 100 TO VALUE-100.
      READ-TAPE.
          READ TAPE-IN AT END GO TO STOP-RUN.
          ADD 1 TO COUNT.
          IF COUNT = 5 MOVE IP  TO HLD-REC-1
               GO TO READ-TAPE.
          IF COUNT = 6 MOVE IP  TO HLD-REC-2
               MOVE HLD-OPEN TO REC-OPEN
               MOVE HLD-CLS TO REC-CLS
               MOVE X-OPEN-1 TO REC-1
               MOVE X-OPEN-2 TO REC-1-1
               MOVE X-CLS TO REC-2
               MOVE HLD-REC-1 TO OP
               WRITE OP
               MOVE HLD-REC-2 TO OP
               WRITE OP
               MOVE SPACES TO HLD-REC
               GO TO READ-TAPE.
          IF AST = '*' MOVE IP TO OP WRITE OP
               GO TO LAST-AST.
          MOVE IP TO OP.
          WRITE OP.
          GO TO READ-TAPE.
```

16 - APPLY INITIAL EDIT (cont'd)

```
LAST-AST.
    READ TAPE-IN AT END GO TO STOP-RUN.
    MOVE IP TO OP.
    WRITE OP.
PROCESS-TAPE.
    READ TAPE-IN AT END GO TO STOP-RUN.
    MOVE IP TO OP.
    IF CH-5 LESS THAN VALUE-05
         MOVE ZEROS TO OP-CH-5, OP-CH-4.
    IF CH-3 LESS THAN VALUE-X
         MOVE ZEROS TO OP-CH-4, OP-CH-5.
    IF CH-3 LESS THAN VALUE-100
         MOVE ZEROS TO OP-CH-3, OP-CH-4, OP-CH-5.
    MOVE CH-8       TO OP-CH-8.
    WRITE OP.
    MOVE SPACES TO OP.
    GO TO PROCESS-TAPE.
 STOP-RUN.
    CLOSE CARD-IN, TAPE-IN WITH NO REWIND,
         TAPE-OUT WITH NO REWIND.
    STOP RUN.
```

17 - CONVERT RAW DATA TO FLOATING POINT

```
// EXEC COBOL
01010  IDENTIFICATION DIVISION.
01020  PROGRAM-ID.  'FLOAT'.
01030  ENVIRONMENT DIVISION.
01040  INPUT-OUTPUT SECTION.
01050  FILE-CONTROL.
01070      SELECT TAPIN ASSIGN 'SYS011' UTILITY 2400.
01080      SELECT TAPOT ASSIGN 'SYS012' UTILITY 2400.
01090      SELECT PRTF ASSIGN 'SYS009' UNIT-RECORD 1403.
01100  DATA DIVISION.
01110  FILE SECTION.
01120  FD  TAPIN
01130          RECORDING MODE F,
01140          LABEL RECORDS OMITTED,
01150          RECORD CONTAINS  30 CHARACTERS,
01160          BLOCK CONTAINS 120 RECORDS,
01170          DATA RECORD TAPIN-REC.
01220  01  TAPIN-REC.
01230      07  TRK       PICTURE  99.
01240      07  TIME      PICTURE S99V99.
01350      07  VOL       PICTURE SV999    OCCURS 8 TIMES.
01360  FD  TAPOT
01370          RECORDING MODE F,
01380          LABEL RECORDS OMITTED,
01390          RECORD CONTAINS  40 CHARACTERS,
01400           BLOCK CONTAINS 270 RECORDS,
01410          DATA RECORD TAPOT-REC.
01420  01  TAPOT-REC.
01430      07  TRK-O     PICTURE 99.
01440      07  TIME-O    PICTURE 99V99.
01450      07  DAY-O       PICTURE XX.
01460      07  VOL-O    COMPUTATIONAL-1  OCCURS 8 TIMES.
01470  FD  PRTF
01480          RECORDING MODE F, LABEL RECORDS OMITTED,
01490          DATA RECORD PRT.
01500  01  PRT.
02010      07  FILLER    PICTURE X.
02020      07  PRT1        PICTURE X(132).
02030      07  PRT2 REDEFINES PRT1.
02040          14  REC  PICTURE Z(7).
02050          14  FILLER PICTURE XXX.
02060          14  P-TRK  PICTURE 99.
02070          14  FILLER  PICTURE XXX.
02080          14  P-TIME  PICTURE 99.99.
02090          14  P-VOL  PICTURE -----.999, OCCURS 8 TIMES.
02100          14  FILLER  PICTURE XXX.
02110          14  R-V  PICTURE  -(7).9(3).
02113          14  FILLER     PICTURE X(4).
02115          14  P-ZERO     PICTURE X(4).
02120      07  PRT3  REDEFINES  PRT1.
02130          14  PRT4   PICTURE X(40).
02140          14  PRT5   PICTURE X(40).
02150      07  PRT6  REDEFINES  PRT1.
02160          14  PRT7   PICTURE X(30).
02170          14  PRT8   PICTURE X(30).
02180          14  PRT9   PICTURE X(30).
```

```
02190  WORKING-STORAGE SECTION.
02220  77  CNT  PICTURE S9(7)  VALUE ZERO  COMPUTATIONAL-3.
02235  77  ASTSK          PICTURE X, VALUE SPACE.
       77  S-TIME   PICTURE S9V99  COMPUTATIONAL-3.
       77  BSR  PICTURE S999 COMPUTATIONAL, VALUE 12.

       01  MSG.
           07  FILLER    PICTURE X.
           07  MSG-N     PICTURE Z,ZZZ,ZZZ.
           07  FILLER    PICTURE X(18) VALUE ' RECORDS PROCESSED'.

02300  01  HEADINGS.
02350      07  PRT6H.
02360          14  FILLER      PICTURE X.
02370          14  PRT6H1.
02380              20  PRT6HA      PICTURE X(30).
02390              20  PRT6HB      PICTURE X(30).
02400              20  PRT6HC      PICTURE X(30), VALUE SPACE.
02410          14  FILLER      PICTURE X(10) VALUE ' RAW-FLOAT'.
               14  FILLER      PICTURE X(5)  VALUE SPACE.
               14  PRT6-D      PICTURE X(20) VALUE SPACE.
02420      07  PRTH.
02430          14  FILLER      PICTURE X(17) VALUE '  RECORD  TRK    '.
02440          14  FILLER      PICTURE X(12) VALUE 'TIME        '.
02450          14  FILLER      PICTURE X(09) VALUE '3        '.
02460          14  FILLER      PICTURE X(09) VALUE '4        '.
02470          14  FILLER      PICTURE X(09) VALUE '5        '.
02480          14  FILLER      PICTURE X(09) VALUE '6        '.
02490          14  FILLER      PICTURE X(09) VALUE '7        '.
02500          14  FILLER      PICTURE X(09) VALUE '8        '.
03010          14  FILLER      PICTURE X(08) VALUE '9       '.
03020          14  FILLER      PICTURE X(16) VALUE '10              '.
03030      07  LINCNT   PICTURE S9(3) VALUE ZERO  COMPUTATIONAL-3.
03040  PROCEDURE DIVISION.
03140          OPEN INPUT TAPIN WITH NO REWIND.
03150          OPEN OUTPUT TAPOT WITH NO REWIND.
03170      OPEN OUTPUT        PRTF.
           ENTER LINKAGE.
               CALL 'NOTPMK' USING BSR.
           ENTER COBOL.
           ENTER LINKAGE.
               CALL 'GETDAT' USING PRT6-D.
           ENTER COBOL.

05050      READ TAPIN INTO PRT7 AT END STOP RUN.
05060      READ TAPIN INTO PRT8 AT END STOP RUN.
05070      READ TAPIN INTO PRT9 AT END STOP RUN.
           WRITE TAPOT-REC FROM PRT4.
           WRITE TAPOT-REC FROM PRT5.
           MOVE PRT7 TO PRT6HA.
           MOVE PRT8 TO PRT6HB.
           MOVE PRT9 TO PRT6HC.
           PERFORM W-HD-2.

05040  SEMI-RAW-PRINT.
05045      MOVE SPACE TO PRT.
```

17 - CONVERT RAW DATA TO FLOATING POINT (cont'd)

```
05050      READ TAPIN INTO PRT7 AT END STOP RUN.
05060      READ TAPIN INTO PRT8 AT END STOP RUN.
05070      READ TAPIN INTO PRT9 AT END STOP RUN.
05075      IF PRT7 = '*' MOVE '*' TO ASTSW.
           WRITE TAPOT-REC FROM PRT4.
           WRITE TAPOT-REC FROM PRT5.
05080      WRITE  PRT AFTER 1.
05090      ADD 1 TO LINCNT.
05100      IF ASTSW = '*' GO TO END-SEMI-RAW-CTL.
05110      IF LINCNT GREATER THAN 56 PERFORM W-HD-2.
05120      GO TO SEMI-RAW-PRINT.
05130  END-SEMI-RAW-CTL.
05140      IF LINCNT GREATER THAN 40 PERFORM W-HD-2.

05490  READ-LOOP.
06010      READ TAPIN AT END GO TO END-FILE.
06370      MOVE TRK TO TRK-O.
06380      MOVE TIME TO S-TIME.
           MOVE S-TIME TO TIME-O.
06390      MOVE '  ' TO DAY-O.
           MOVE VOL (1) TO VOL-O (1).
           MOVE VOL (2) TO VOL-O (2).
           MOVE VOL (3) TO VOL-O (3).
           MOVE VOL (4) TO VOL-O (4).
           MOVE VOL (5) TO VOL-O (5).
           MOVE VOL (6) TO VOL-O (6).
           MOVE VOL (7) TO VOL-O (7).
           MOVE VOL (8) TO VOL-O (8).
06030      MOVE SPACE TO PRT.
06040      ADD 1 TO CNT.  MOVE CNT TO REC.
06070      IF CNT GREATER THAN 249   GO TO WR-TAPE.
06080      MOVE TRK TO P-TRK.
06090      MOVE TIME TO P-TIME.
           MOVE VOL-O (1) TO P-VOL (1).
           MOVE VOL-O (2) TO P-VOL (2).
           MOVE VOL-O (3) TO P-VOL (3).
           MOVE VOL-O (4) TO P-VOL (4).
           MOVE VOL-O (5) TO P-VOL (5).
           MOVE VOL-O (6) TO P-VOL (6).
           MOVE VOL-O (7) TO P-VOL (7).
           MOVE VOL-O (8) TO P-VOL (8).
           IF P-TRK = 00
               MOVE 'ZERO' TO P-ZERO.
06210      WRITE PRT AFTER 1.
06220      ADD 1 TO LINCNT.
06230      IF LINCNT NOT GREATER THAN 56
06240          GO TO WR-TAPE.
06250  W-HD-2.
06260      WRITE PRT FROM PRT6H AFTER 0.
06270      WRITE PRT FROM PRTH AFTER 2.
06280      MOVE  3   TO LINCNT.
06290      MOVE SPACE TO PRT.
06300      WRITE PRT AFTER 1.
06360  WR-TAPE.
06420      WRITE TAPOT-REC.
06430      GO TO READ-LOOP.
```

```
06440  END-FILE.
           MOVE CNT TO MSG-N.
           WRITE PRT FROM MSG AFTER 2.
           CLOSE TAPIN WITH NO REWIND, TAPOT WITH NO REWIND,
               PRTF.
06450      STOP RUN.
```

18 - HORSEPOWER MODEL DEVELOPMENT

```
// JOB 120210  HORSEPOWER MODEL DEVELOPMENT
// OPTION LINK,DECK
// EXEC FORTRAN
C
C
C
C       **********  CONVERT X TO LOAD FACTOR  **********
C
C
C
      DIMENSION  HEAD (45)
      WRITE   (3,5)
    5 FORMAT ( 1H1 )
    6 READ (1,4) A,B
    4 FORMAT ( F11.5,4X,F11.5)
    3 READ (1,1,END=99) I,IRPM,X,IHP,CH3,HEAD
      IF (I. ..99999) GO TO 6
    1 FORMAT(I5,I5,F5.3,I9,F6.3,5X,45A1)
      HP =  A*X + B
      IH  =  HP *1000
      IH1 =  IH/1000
      IH2 = IH-IH1*1000
      IF(IH1.LT.0)IH1=0
      IF(IH2.LT.0)IH2=1
      WRITE (4,8) I,IRPM,IH1,IH2,IHP,HEAD
    8 FORMAT ( I5,I5,I3,I3,I7,12X,45A1)
      WRITE (2,2) I,IRPM,IH1,IH2,IHP,CH3,X,HEAD
    2 FORMAT ( I5,I5,I3,I3,I7,F6.3,F6.3,45A1)
      WRITE (3,2) I,IRPM,IH1,IH2,IHP,CH3,X,HEAD
      GO TO 3
   99 STOP
      END
```

```
// EXEC LNKEDT
// ASSGN SYS001,X'180'
// EXEC
C
C
C
C       **********  BUILD REGRESSION DATA DECK TO THE 5TH POWER  **********
C
C
C
      IMPLICIT REAL*8 (H,R,X)
      DIMENSION FUEL(3)
      WRITE (3,2)
      INUM=0
    2 FORMAT (1H1)
    3 READ (4,1,END=99) I,RPM,X,HP,TYPE,FUEL
    1 FORMAT (I5,F5.4,F6.3,F7.0,41X,A4,   3A4)
      J=1
      HP=HP*100.
      X2=X**2
      X3=X**3
      X4=X**4
      X5=X**5
      RPMX =RPM*X
      RPMX2=RPM*X2
      RPMX3=RPM*X3
      RPMX4=RPM*X4
      RPMX5=RPM*X5
      RPM2 =RPM**2
      RPM2X =RPM2*X
      RPM2X2=RPM2*X2
      RPM2X3=RPM2*X3
      RPM2X4=RPM2*X4
      RPM2X5=RPM2*X5
      RPM3 = RPM**3
      RPM3X =RPM3*X
      RPM3X2=RPM3*X2
      RPM3X3=RPM3*X3
      RPM3X4=RPM3*X4
      RPM3X5=RPM3*X5
      J1=X
      J2=(X-FLOAT(J1))*1000000000.
      J3=RPM
      J4=(RPM-FLOAT(J3))*1000000000.
      I   =X2
      I1  =(X2-FLOAT(I1))*1000000000.
      I2  =X3
      I3  =(X3-FLOAT(I2))*1000000000.
      I4  =X4
      I5  =(X4-FLOAT(I4))*1000000000.
      I6  =X5
C
      I7  =(X5-FLOAT(I6))*1000000000.
C
      I8  =RPMX
      I   =(RPMX-FLOAT(I8))*1000000000.
```

18 - HORSEPOWER MODEL (con'd)

```
I10=RPMX2
J9=I10
I11=(RPMX2-FLOAT(J9))*1CCCCCCCCC.
I12=RPMX3
I13=(RPMX3-FLOAT(I12))*1C0CCCCCCC.
I14=RPMX4
I15=(RPMX4-FLOAT(I14))*1CCCCCCCCC.
I16=RPMX5
I17=(RPMX5-FLOAT(I16))*1CCCCCCCCC.
I18=RPM2
I19=(RPM2-FLOAT(I18))*1CCCCCCCCC.
I20=RPM2X
I21=(RPM2X-FLOAT(I2C))*100CCCCCC0.
I22=RPM2X2
I23=(RPM2X2-FLOAT(I22))*1CCCCCCCCC.
I24=RPM2X3
I25=(RPM2X3-FLOAT(I24))*1CCCCCCCCC.
I26=RPM2X4
I27=(RPM2X4-FLCAT(I26))*1COCCG000C.
I28=RPM2X5
I29=(RPM2X5-FLOAT(I28))*1CCCCCCOCC.
IP=HP
I3C= RPM3
I31=(RPM3-FLOAT(I30))*1CCCCCOCCC.
I32= RPM3X
I33 =(RPM3X-FLOAT(I32))*1CCCCCCCCC.
I34=RPM3X2
I35=(RPM3X2-FLOAT(I34))*1CCCCCOCCC.
I36= RPM3X3
I37=(RPM3X3-FLOAT(I36))*1CCCCCCCCC.
I38=RPM3X4
I39=(RPM3X4-FLOAT(I38))*10CCCCCCCC.
I4C=RPM3X5
I41=(RPM3X5-FLOAT(I4C))*1COCCCCCCC.
 IF ( I1 .GT. 999999999 ) I1 =I1 /10
 IF ( I2 .GT. 999999999 ) I2 =I2 /1C
 IF ( I3 .GT. 999999999 ) I3 =I3 /1C
 IF ( I4 .GT. 999999999 ) I4 =I4 /10
 IF ( I5 .GT. 999999999 ) I5 =I5 /10
 IF ( I6 .GT. 999999999 ) GC TC 8
 IF ( I7 .GT. 999999999 ) GC TO 6
 IF ( I8 .GT. 999999999 ) I8 =I8 /1C
 IF ( I9 .GT. 999999999 ) I9 =I9 /1C
 IF ( I1C.GT. 999999999 ) I1C=I1C/1C
 IF ( I11.GT. 999999999 ) I11=I11/1C
 IF ( I12.GT. 999999999 ) I12=I12/1C
 IF ( I13.GT. 999999999 ) I13=I13/1C
 IF ( I14.GT. 999999999 ) I14=I14/10
 IF ( I15.GT. 999999999 ) I15=I15/10
 IF ( I16.GT. 999999999 ) I16=I16/10
 IF ( I17.GT. 999999999 ) I17=I17/1C
 IF ( I18.GT. 999999999 ) I18=I18/1C
 IF ( I19.GT. 999999999 ) I19=I19/1C
 IF ( I2C.GT. 999999999 ) I2C=I2C/1C
 IF ( I21.GT. 999999999 ) I21=I21/1C
 IF ( I22.GT. 999999999 ) I22=I22/1C
 IF ( I23.GT. 999999999 ) I23=I23/1C
 IF ( I24.GT. 999999999 ) I24=I24/1C
 IF ( I25.GT. 999999999 ) I25=I25/1C
 IF ( I26.GT. 999999999 ) I26=I26/1C
 IF ( I27.GT. 999999999 ) I27=I27/1C
 IF ( I28.GT. 999999999 ) I28=I28/1C
 IF ( I29.GT. 999999999 ) I29=I29/1C
 IF ( I3C.GT. 999999999 ) I3C=I30/1C
 IF ( I31.GT. 999999999 ) I31=I31/1C
 IF ( I32.GT. 999999999 ) I32=I32/1C
 IF ( I33.GT. 999999999 ) I33=I33/1C
 IF ( I34.GT. 999999999 ) I34=I34/1C
 IF ( I35.GT. 999999999 ) I35=I35/1C
 IF ( I36.GT. 999999999 ) I36=I36/1C
 IF ( I37.GT. 999999999 ) I37=I37/1C
 IF ( I38.GT. 999999999 ) I38=I38/1C
 IF ( I39.GT. 999999999 ) I39=I39/1C
 IF ( I4C.GT. 999999999 ) I4C=I4C/10
 IF ( I41.GT. 999999999 ) I41=I41/1C
 INCM=INCM+1
 J=INCM
 WRITE (5,4) J,IP,TYPE,FUEL,J1,J2,I,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,
* I11,
*I12,I13,I14,I15,I16,I17,I18,I19,I2C,I21,I22,I23,I24,I25,I26,I27,
*I28,I29,J3,J4,I3C,I31,I32,I33,I34,I35,I36,I37,I38,I39,I40,I41
 WRITE (3,4) J,IP,TYPE,FUEL,J1,J2,I,I1,I2,I3,I4,I5,I6,I7,I8,I9,I1C,
* I11,
*I12,I13,I14,I15,I16,I17,I18,I19,I20,I21,I22,I23,I24,I25,I26,I27,
*I28,I29,J3,J4,I3C,I31,I32,I33,I34,I35,I36,I37,I38,I39,I40,I41
4 FORMAT (I5,I8,50X,A4,3A4,1X,5(/,4(I11,I9))/,3(I11,I9,20X))
 WRITE (3,5) J,IP,TYPE,FUEL,X,X2,X3,X4,X5,RPMX,RPMX2,RPMX3,
*RPMX4,RPMX5,
*          RPM2,RPM2X,RPM2X2,RPM2X3,RPM2X4,RPM2X5,RPM,RPM3,RPM3X,
*RPM3X2,RPM3X3,RPM3X4,RPM3X5
5 FORMAT (1CX,I5,I8,46X,A4,3A4,5(/,1CX,4(F20.9)),/,1CX,3(F2C.9)/)
 GO TO 3
8 I6 = I6/1C
 GO TO 9
6 I7 = I7/1C
 GO TO 7
99 STOP
 END
```

18 - HORSEPOWER MODEL (cont'd)

```
// EXEC LNKEDT
// ASSGN SYS001,X'180'
// ASSGN SYS002,X'181'
// ASSGN SYS003,X'182'
// EXEC
```

```
// ASSGN SYS002,X'00C'
// ASSGN SYS003,X'00E'
// ASSGN SYS004,X'180'
// ASSGN SYS005,X'181'
// ASSGN SYS006,X'182'
C
C
C      *********  RUN MULTIPLE REGRESSION PROGRAM, BMD PACKAGE  *********
C
C
```